INTERIOR CARE

To remove dust and loose dirt from the upholstery and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with foam type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

For complete information related to interior cleaning, refer to the Maintenance Manual.

8-24 Revision 8

Follow by carefully washing with a mild detergent and plenty of water. Rinse thoroughly, then dry with a clean moist chamois. Do not rub the plastic with a dry cloth since this builds up an electrostatic charge which attracts dust. Waxing with a good commercial wax will finish the cleaning job. A thin, even coat of wax, polished out by hand with clean soft flannel cloths, will fill in minor scratches and help prevent further scratching.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated since the cover may scratch the plastic surface.

PAINTED SURFACES

The painted exterior surfaces of your new Cessna have a durable, long lasting finish.

Generally, the painted surfaces can be kept bright by washing with water and mild soap, followed by a rinse with water and drying with cloths or a chamois. Harsh or abrasive soaps or detergents which cause corrosion or scratches should never be used. Remove stubborn oil and grease with a cloth moistened with Stoddard solvent. Take special care to make sure that the exterior graphics are not touched by the solvent. For complete care of exterior graphics refer to the Maintenance Manual.

To seal any minor surface chips or scratches and protect against corrosion, the airplane should be waxed regularly with a good automotive wax applied in accordance with the manufacturer's instructions. If the airplane is operated in a seacoast or other salt water environment, it must be washed and waxed more frequently to assure adequate protection. Special care should be taken to seal around rivet heads and skin laps, which are the areas most susceptible to corrosion. A heavier coating of wax on the leading edges of the wings and tail and on the cowl nose cap and propeller spinner will help reduce the abrasion encountered in these areas. Reapplication of wax will generally be necessary after cleaning with soap solution or after chemical deicing operations.

8-22 Revision 8

FUEL CONTAMINATION

Fuel contamination is usually the result of foreign material present in the fuel system, and may consist of water, rust, sand, dirt, microbes or bacterial growth. In addition, additives that are not compatible with fuel or fuel system components can cause the fuel to become contaminated.

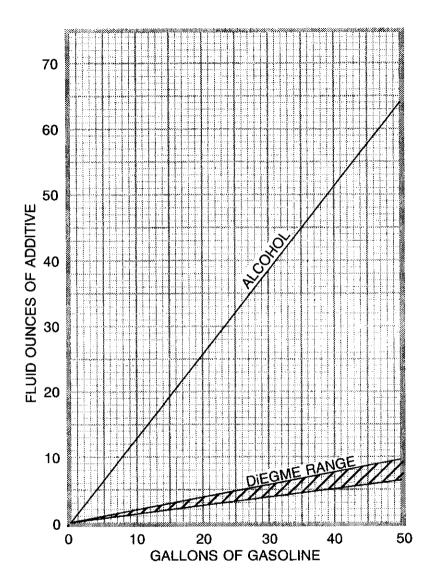
Before each flight and after each refueling, use a clear sampler cup and drain at least a cupful of fuel from each fuel tank drain location and from the fuel strainer quick drain valve to determine if contaminants are present, and to ensure the airplane has been fueled with the proper grade of fuel.

If contamination is detected, drain all fuel drain points again, including the fuel reservoir and fuel selector quick drain valves and then gently rock the wings and lower the tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all fuel drain points until all contamination has been removed. If, after repeated sampling, evidence of contamination still exists, the airplane should not be flown. Tanks should be drained and system purged by qualified maintenance personnel. All evidence of contamination must be removed before further flight. If the airplane has been serviced with the improper fuel grade, defuel completely and refuel with the correct grade. Do not fly the airplane with contaminated or unapproved fuel.

In addition, Owners/Operators who are not acquainted with a particular fixed base operator should be assured that the fuel supply has been checked for contamination and is properly filtered before allowing the airplane to be serviced. Fuel tanks should be kept full between flights, provided weight and balance considerations will permit, to reduce the possibility of water condensing on the walls of partially filled tanks.

To further reduce the possibility of contaminated fuel, routine maintenance of the fuel system should be performed in accordance with the airplane Maintenance Manual. Only the proper fuel, as recommended in this handbook, should be used, and fuel additives should not be used unless approved by Cessna and the Federal Aviation Administration.

8-20 Revision 8



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Figure 8-1. Fuel Mixing Ratio

8-18 Feb 28/00

FUEL

APPROVED FUEL GRADES (AND COLORS)

100LL Grade Aviation Fuel (Blue). 100 Grade Aviation Fuel (Green).

NOTE

Isopropyl alcohol or diethylene glycol monomethyl ether (DiEGME) may be added to the fuel supply in quantities not to exceed 1% (alcohol) or 0.15% (DiEGME) of total volume. Refer to Fuel Additives in later paragraphs for additional information.

FUEL CAPACITY

56.0 U.S. Gallons Total: 28.0 U.S. Gallons per tank.

NOTE

To ensure maximum fuel capacity when refueling and minimize cross feeding, the fuel selector valve should be placed in either the LEFT or RIGHT position and the airplane parked in a wings level, normal ground attitude. Refer to Figure 1-1 for a definition of normal ground attitude.

Service the fuel system after each flight, and keep fuel tanks full to minimize condensation in the tanks.

FUEL ADDITIVES

Strict adherence to recommended preflight draining instructions as called for in Section 4 will eliminate any free water accumulations from the tank sumps. While small amounts of water may still remain in solution in the gasoline, it will normally be consumed and go unnoticed in the operation of the engine.

8-16 Feb 28/00

Depending on various flight operations, your local Government Aviation Agency may require additional service, inspections, or tests. For these regulatory requirements, owners should check with local aviation officials where the airplane is being operated.

For quick and ready reference, quantities, materials and specifications for frequently used service items are as follows.

OIL

OIL SPECIFICATION

- MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil: Used when the airplane was delivered from the factory and should be used to replenish the supply during the first 25 hours. This oil should be drained and filter replaced after the first 25 hours of operation. Refill the engine and continue to use until a total of 50 hours has accumulated or oil consumption has stabilized.
- MIL-L-22851 or SAE J1899 Aviation Grade Ashless Dispersant Oil: Oil conforming to Textron Lycoming Service Instruction No. 1014, and all revision and supplements thereto, must be used after first 50 hours, or when oil consumption has stabilized.

RECOMMENDED VISCOSITY FOR TEMPERATURE RANGE

Multiviscosity or straight grade oil may be used throughout the year for engine lubrication. Refer to the following table for temperature verses viscosity ranges.

temperature verses viscosity ranges.

Temperature	MIL-L-6082 or SAE J1966 Straight Mineral Oil	MIL-L-22851 or SAE J1899 Ashless Dispersant SAE Grade	
	SAE Grade		
Above 27°C (80°F)	60	60	
Above 16°C (60°F)	50	40 or 50	
-1°C (30°F) to 32°C (90°F)	40	40	
-18°C (0°F) to 21°C (70°F)	30	30, 40 or 20W-40	
Below -12°C (10°F)	20	30 or 20W-30	
-18°C (0°F) to 32°C (90°F)	20W-50	20W-50 or 15W-50	
All Temperatures		15W-50, 20W-50	

8-14 Revision 8

CESSNA MODEL 172R

To assist in raising and holding the nose wheel off the ground, ground anchors should be utilized at the tail tie down point.

NOTE

Ensure that the nose will be held off the ground under all conditions by means of suitable stands or supports under weight supporting bulkheads near the nose of the airplane.

LEVELING

Longitudinal leveling of the airplane is accomplished by placing a level on leveling screws located on the left side of the tailcone. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level. Corresponding points on both upper door sills may be used to level the airplane laterally.

FLYABLE STORAGE

Airplanes placed in non operational storage for a maximum of 30 days or those which receive only intermittent operational use for the first 25 hours are considered in flyable storage status. Every seventh day during these periods, the propeller should be rotated by hand through five revolutions. This action "limbers" the oil and helps prevent any accumulation of corrosion on engine cylinder walls.

8-12 Feb 28/00

GROUND HANDLING

TOWING

The airplane is most easily and safely maneuvered by hand with the tow bar attached to the nose wheel (the tow bar is stowed on the side of the baggage area). When towing with a vehicle, do not exceed the nose gear turning angle of 30° either side of center, or damage to the nose landing gear will result.

A CAUTION

REMOVE ANY INSTALLED RUDDER LOCK BEFORE TOWING.

If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose strut does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose tire or deflated strut will also increase tail height.

PARKING

When parking the airplane, head into the wind and set the parking brakes. Do not set the parking brakes during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated. Install the control wheel lock and chock the wheels. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

8-10 Feb 28/00

CESSNA INSPECTION PROGRAMS

In lieu of the 100 hour and annual inspection requirements, an airplane may be inspected in accordance with a Progressive Care Inspection Program or a Phase Card Inspection Program. Both programs offer systems which allow the work load to be divided into smaller operations that can be accomplished in shorter time periods.

The Cessna Progressive Care Inspection Program allows an airplane to be inspected and maintained in four operations. The four operations are recycled each 200 hours and are recorded in a specially provided Aircraft Inspection Log as each operation is conducted.

The Phase Card Inspection Program offers a parallel system for high-utilization flight operations (approximately 600 flight hours per year). This system utilizes 50 hour intervals (Phase 1 and Phase 2) to inspect high-usage systems and components. At 12 months or 600 flight hours, whichever occurs first, the airplane undergoes a complete (Phase 3) inspection.

Regardless of the inspection method selected, the owner should keep in mind that FAR Part 43 and FAR Part 91 establishes the requirement that properly certified agencies or personnel accomplish all required FAA inspections and most of the manufacturer recommended inspections.

CESSNA CUSTOMER CARE PROGRAM

Specific benefits and provisions of the Cessna Warranty plus other important benefits for you are contained in your Customer Care Program Handbook supplied with your airplane. The Customer Care Program Handbook should be thoroughly reviewed and kept in the airplane at all times.

You will also want to return to your Cessna Service Station either at 50 hours for your first Progressive Care Operation, or at 100 hours for your first 100 hour inspection depending on which program you choose to establish for your airplane. While these important inspections will be performed for you by any Cessna Service Station, in most cases you will prefer to have the Cessna Service Station from whom you purchased the airplane accomplish this work.

8-8 Feb 28/00

The following additional publications, plus many other supplies that are applicable to your airplane, are available from your local Cessna Service Station.

- Information Manual (contains Pilot's Operating Handbook Information)
- Maintenance Manual, Wiring Diagram Manual and Illustrated Parts Catalog

Your local Cessna Service Station has a Customer Care Supplies and Publications Catalog covering all available items, many of which the Service Station keeps on hand. The Service Station can place an order for any item which is not in stock.

NOTE

A Pilot's Operating Handbook and FAA Approved Airplane Flight Manual which is lost or destroyed may be replaced by contacting your local Cessna Service Station. An affidavit containing the owner's name, airplane serial number and reason for replacement must be included in replacement requests since the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual is identified for specific serial numbered airplanes only.

AIRPLANE FILE

There are miscellaneous data, information and licenses that are a part of the airplane file. The following is a checklist for that file. In addition, a periodic check should be made of the latest Federal Aviation Regulations to ensure that all data requirements are met.

To be displayed in the airplane at all times:

- 1. Aircraft Airworthiness Certificate (FAA Form 8100-2).
- 2. Aircraft Registration Certificate (FAA Form 8050-3).
- 3. Aircraft Radio Station License, (if applicable).

IDENTIFICATION PLATE

All correspondence regarding your airplane should include the Serial Number. The Serial Number, Model Number, Production Certificate Number (PC) and Type Certificate Number (TC) can be found on the Identification Plate, located on the aft left tailcone. A secondary Identification Plate is installed on the lower part of the left forward doorpost on earlier serial number airplanes. The Finish and Trim Plate, located on the lower part of the left forward doorpost, contains a code describing the exterior paint configuration for the airplane. The code may be used in conjunction with an applicable Illustrated Parts Catalog if finish and trim information is needed.

CESSNA OWNER ADVISORIES

Cessna Owner Advisories are sent to Cessna Aircraft FAA Registered owners of record at no charge to inform them about mandatory and/or beneficial aircraft service requirements and product changes. Copies of the actual bulletins are available from Cessna Service Stations and Cessna Customer Service.

8-4 Revision 8

TABLE OF CONTENTS (Continued)

Fuel	15
Oil and Oil Filter Change 8- Fuel 8- Approved Fuel Grades (and Colors) 8- Fuel Capacity 8- Fuel Additives 8- Fuel Contamination 8- Landing Gear 8-	
Fuel	• •
Approved Fuel Grades (and Colors) 8- Fuel Capacity 8- Fuel Additives 8- Fuel Contamination 8- Landing Gear 8-	16
Fuel Capacity	
Fuel Additives	16
Fuel Contamination	16
Fuel Contamination	16
Landing Gear 8-	20
	21
Cleaning And Care 8-	21
3881-62-1-1 A J.389)	21
Date: LO /	22
B	23
English O.	23
	24

8-2 Feb 28/00

WARNING

VENTILATE THE CABIN PROMPTLY AFTER SUCCESSFULLY EXTINGUISHING THE FIRE TO REDUCE THE GASES PRODUCED BY THERMAL DECOMPOSITION.

3. Anticipate approximately eight seconds of discharge duration.

Fire extinguishers should be recharged by a qualified fire extinguisher agency after each use. Such agencies are listed under "Fire Extinguisher" in the telephone directory. After recharging, secure the extinguisher to its mounting bracket; do not allow it to lie loose on shelves or seats.

NOTE

To ensure audibility and clarity when transmitting with the handheld microphone, always hold it as closely as possible to the lips, then key the microphone and speak directly into it. Avoid covering opening on back side of microphone for optimum noise canceling.

STATIC DISCHARGERS

Static wicks (static dischargers) are installed at various points throughout the airframe to reduce interference from precipitation static. Under some severe static conditions, loss of radio signals is possible even with static dischargers installed. Whenever possible, avoid known severe precipitation areas to prevent loss of dependable radio signals. If avoidance is impractical, minimize airspeed and anticipate temporary loss of radio signals while in these areas.

Static dischargers lose their effectiveness with age, and therefore, should be checked periodically (at least at every annual inspection) by qualified avionics technicians, etc.

7-48 Dec 2/96

CLOCK / O.A.T. INDICATOR

An integrated clock / O.A.T. / voltmeter is installed in the upper left side of the instrument panel as standard equipment. For a complete description and operating instructions, refer to the Supplements, Section 9.

STALL WARNING SYSTEM

The airplane is equipped with a pneumatic type stall warning system consisting of an inlet in the leading edge of the left wing, an air-operated horn near the upper left corner of the windshield, and associated plumbing. As the airplane approaches a stall, the low pressure on the upper surface of the wings moves forward around the leading edge of the wings. This low pressure creates a differential pressure in the stall warning system which draws air through the warning horn, resulting in an audible warning at 5 to 10 knots above stall in all flight conditions.

STANDARD AVIONICS

Standard avionics for the Model 172R airplanes include the following equipment:

KX-155A	Nav/Com Radio with KI 208 or KI 209.	A
	Indicator Head	
KT-76C	Transponder	
KMA-26	Audio Panel	
3000-11	Emergency Locator Transmitter (ELT)	

For complete operating instructions on the standard and optional avionics systems, refer to the Supplements, Section 9.

7-46 Feb 28/00

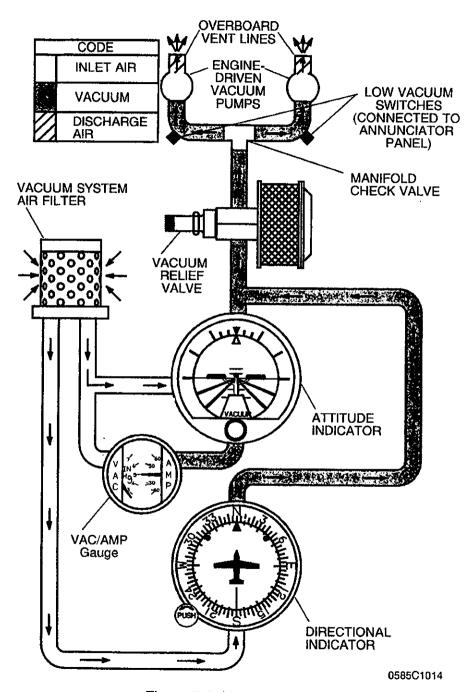


Figure 7-9. Vacuum System

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots. It incorporates a true airspeed window which allows true airspeed to be read off the face of the dial. In addition, the indicator incorporates a window at the twelve o'clock position. The window displays true airspeed, and the window at the twelve o'clock position displays pressure altitude overlayed with a temperature scale.

Limitation and range markings (in KIAS) include the white arc (33 to 85 knots), green arc (44 to 129 knots), yellow arc (129 to 163 knots), and a red line (163 knots).

To find true airspeed, first determine pressure altitude and outside air temperature. Using this data, rotate the lower left knob until pressure altitude aligns with outside air temperature in the twelve o'clock window. True airspeed (corrected for pressure and temperature) can now be read in the lower window.

VERTICAL SPEED INDICATOR

The vertical speed indicator depicts airplane rate of climb or descent in feet per minute. The pointer is actuated by atmospheric pressure changes resulting from changes of altitude as supplied by the static source.

7-42 Dec 2/96

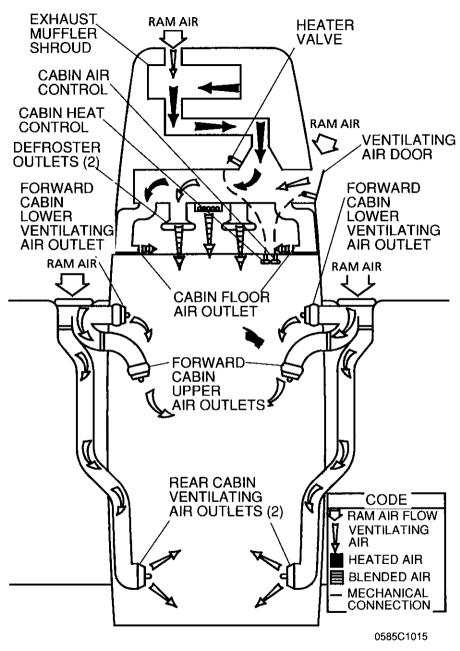


Figure 7-8. Cabin Heating, Ventilating and Defrosting System.

7-40 Feb 28/97

Glareshield lighting is provided by either a fluorescent light or a series of LED lights recessed into the lower surface of the glareshield. This light is controlled by rotating the GLARESHIELD LT dimmer, located below the nav indicators. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decrease light intensity.

Pedestal lighting consists of a single, hooded light located above the fuel selector. This light is controlled by rotating the PEDESTAL LT dimmer, located below the nav indicators. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decreases light intensity.

Panel lighting is accomplished using individual lights mounted in each instrument and gauge. These lights are wired in parallel and are controlled by the PANEL LT dimmer, located below the nav indicators. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decreases light intensity.

Pilot control wheel lighting is accomplished by use of a rheostat and light assembly, located underneath the pilot control wheel. The light provides downward illumination from the bottom of the control wheel to the pilot's lap area. To operate the light, first turn on the NAV light switch, then adjust the map light intensity with the knurled rheostat knob. Rotating the dimmer clockwise increases light intensity, and rotating the dimmer counterclockwise decreases light intensity.

In addition to the RADIO LT dimmer, lighting intensity for the avionics displays and the NAV indicators (pilot's panel) is controlled by the annunciator panel test switch. When the switch is in the BRT position (earlier serial number airplanes) or the DAY position (later serial number airplanes), this lighting may be off regardless of the RADIO LT dimmer position.

Regardless of the light system in question, the most probable cause of a light failure is a burned out bulb. However, in the event any of the lighting systems fail to illuminate when turned on, check the appropriate circuit breaker. If the circuit breaker has opened, and there is no obvious indication of a short circuit (smoke or odor), turn off the light switch of the affected light, reset the breaker, and turn the switch on again. If the breaker opens again, do not reset it.

7-38 Revision 8

EXTERNAL POWER RECEPTACLE

An external power receptacle is integral to the power distribution module and allows the use of an external electrical power source for cold weather starting, and during lengthy maintenance work on electrical and avionics equipment. The receptacle is located on the left side of the engine cowling, just forward of the firewall and midway up the side. Access to the receptacle is gained by removing the cover plate (earlier serial number airplanes) or opening the hinged access door (later serial number airplanes).

The power distribution module (J-Box) incorporates a circuit which will close the battery contactor when external power is applied through the ground service plug receptacle with the master switch turned on. This feature is intended as a servicing aid when battery power is too low to close the contactor, and should not be used to avoid performing proper maintenance procedures on a low battery.

NOTE

- If no avionics equipment is to be used or serviced, the avionics master switch should be in the OFF position. If maintenance is required on the avionics equipment, use a regulated external power source to prevent damage to the avionics equipment by transient voltage. Do not crank or start the engine with the avionics master switch in the ON position.
- Before connecting an external power source (generator type or battery cart), the avionics master switch and the master switch should be turned off.

7-36 Revision 8

AVIONICS MASTER SWITCH

Electrical power for each Avionics Bus is supplied from a primary Electrical Bus. For airplane serial numbers 17280001 through 17280983, except for certain non-U.S. certified airplanes, both Avionics Buses are controlled by a single-section rocker-type Avionics Master switch. At serial number 17280984 and on, a two-section or "split" rocker-type Avionics Master switch controls power to each Avionics Bus independently. Placing the rocker in the up (ON) position provides power to the Avionics Bus. Placing the rocker in the down (OFF) position removes power from the Avionics Bus. The Avionics Master switch is located on the lower left side of the instrument panel.

NOTE

For airplane serial numbers 17280001 through 17280983, aircraft certified outside the United States can have a two-section or "split" Avionics Master switch. The two-section Avionics Master switch enables independent operation of Avionics Bus 1 and Avionics Bus 2.

With the Avionics Master rocker in the OFF position, no electrical power is provided to the avionics, even when the Master switch or the individual avionics component equipment switches are in their ON positions. The Avionics Master switch (both sides, if two-section) should be placed in the OFF position before switching the Master switch ON or OFF, starting the engine, or applying an external power source.

Each avionics bus also incorporates a separate circuit breaker installed between the primary bus and the avionics master switch. In the event of an electrical malfunction, this breaker will trip and take the effected avionics bus off-line.

AMMETER

The ammeter/vacuum gage is located on the lower left side of the instrument panel. It indicates the amount of current, in amperes, from the alternator to the battery or from the battery to the airplane electrical system. When the engine is operating and the master switch is turned on, the ammeter indicates the charging rate applied to the battery. In the event the alternator is not functioning or the electrical load exceeds the output of the alternator, the ammeter indicates the battery discharge rate.

7-34 Revision 8

The airplane uses a power distribution module (J-Box), located on the left forward side of the firewall, to house all relays used throughout the airplane electrical system. In addition, the alternator control unit and the external power connector are housed within the module.

ANNUNCIATOR PANEL

An annunciator panel (with integral toggle switch) is located on the left side of the instrument panel and provides caution (amber) and warning (red) messages for selected portions of the airplane systems. The annunciator is designed to flash messages for approximately 10 seconds to gain the attention of the pilot before changing to steady on. The annunciator panel cannot be turned off by the pilot.

Inputs to the annunciator come from each fuel transmitter, the low oil pressure switch, the vacuum transducers and the alternator control unit (ACU). Individual LED bulbs illuminate each message and may be replaced through the rear of the annunciator. Illumination intensity can be controlled by placing the toggle switch in either the DIM or BRT positions (earlier serial number airplanes) or the DAY or NIGHT positions (later serial number airplanes).

The annunciator panel can be tested by placing the Master switch in the ON position and holding the annunciator panel test switch in the TST (earlier serial number airplanes) or the TEST (later serial number airplanes) position. All amber and red messages will flash until the switch is released.

NOTE

When the Master switch is turned ON, some annunciators will flash for approximately 10 seconds before illuminating steadily. When the annunciator panel test switch is held in the TST (earlier serial number airplanes) or the TEST (later serial number airplanes) position, all remaining lights will flash until the switch is released.

7-32 Revision 8

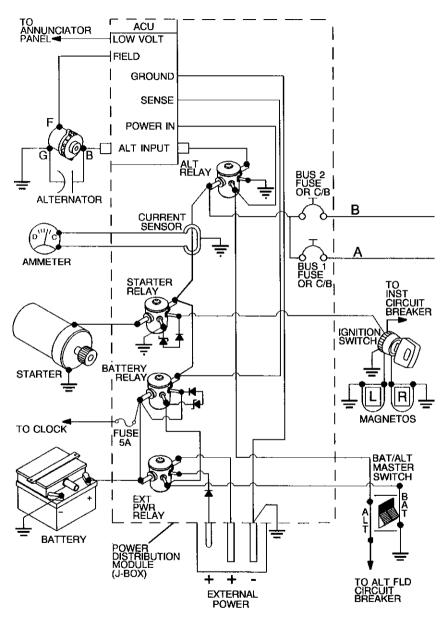


Figure 7-7A. Electrical Schematic (Serials 17280984 and On)(Sheet 1 of 2)

7-30B Revision 7

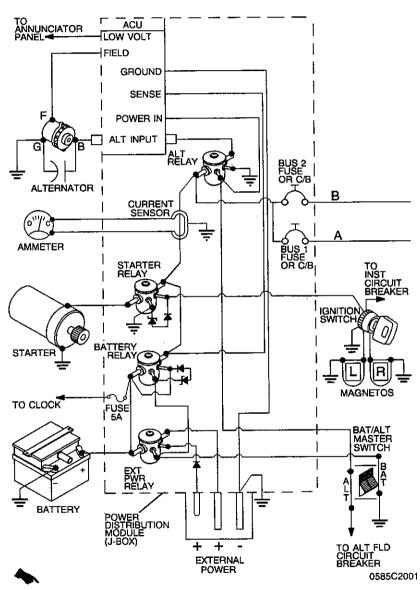


Figure 7-7. Electrical Schematic (Serials 17280001 thru 17280983) (Sheet 1 of 2)

7-30 Dec 30/00

NOTE

When the fuel tanks are 1/4 full or less, prolonged uncoordinated flight such as slips or skids can uncover the fuel tank outlets. Therefore, if operating with one fuel tank dry or if operating on LEFT or RIGHT tank when 1/4 full or less, do not allow the airplane to remain in uncoordinated flight for periods in excess of 30 seconds.

FUEL DRAIN VALVES

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. The system should be examined before each flight and after each refueling, by using the sampler cup provided to drain fuel from each wing tank sump and the fuel strainer sump. If any evidence of fuel contamination is found, it must be eliminated in accordance with the Preflight Inspection checklist and the discussion in Section 8 of this publication. If takeoff weight limitations for the next flight permit, the fuel tanks should be filled after each flight to prevent condensation.

FUEL VENTING

Fuel system venting is essential to system operation. Blockage of the system will result in decreasing fuel flow and eventual engine stoppage. Venting is accomplished by an interconnecting line from the right fuel tank to the left tank. The left fuel tank is vented overboard through a vent line, equipped with a check valve, which protrudes from the bottom surface of the left wing near the wing strut. Both fuel filler caps are also vented.

REDUCED TANK CAPACITY

The airplane may be serviced to a reduced capacity to permit heavier cabin loadings. This is accomplished by filling each tank to the bottom edge of the fuel filler tab, thus giving a reduced fuel load of 17.5 gallons usable in each tank.

FUEL SELECTOR VALVE

The fuel selector valve should be in the BOTH position for takeoff, climb, landing, and maneuvers that involve prolonged slips or skids of more than 30 seconds. Operation from either LEFT or RIGHT tank is reserved for cruising flight.

NOTE

When the fuel selector valve handle is in the BOTH position in cruising flight, unequal fuel flow from each tank may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the tank in the "heavy" wing. It is not practical to measure the time required to consume all of the fuel in one tank, and, after switching to the opposite tank, expect an equal duration from the remaining fuel. The airspace in both fuel tanks is interconnected by a vent line and, therefore, some sloshing of fuel between tanks can be expected when the tanks are nearly full and the wings are not level.

7-26 Feb 28/97

FUEL TANKS	FUEL LEVEL (QUANTITY EACH TANK)		TOTAL UNUSABLE	TOTAL USABLE ALL FLIGHT CONDITIONS
Two	Full (28.0)	56.0	3.0	53.0

Figure 7-5. Fuel Quantity Data in U.S. Gallons

FUEL DISTRIBUTION

Fuel flows by gravity from the two wing tanks to a three-position selector valve, labeled BOTH, RIGHT and LEFT and on to the reservoir tank. From the reservoir tank fuel flows through the auxiliary fuel pump, past the fuel shutoff valve, through the fuel strainer to an engine driven fuel pump.

From the engine driven fuel pump, fuel is delivered to the fuel/air control unit, where it is metered and directed to a fuel distribution valve (manifold) which distributes it to each cylinder. Fuel flow into each cylinder is continuous, and flow rate is determined by the amount of air passing through the fuel/air control unit.

Starting at serial number 17281188 and on, and airplanes incorporating MK172-28-01, a fuel return system was added to promote smooth engine operation on the ground during hot weather. The return system carries a metered amount of fuel from the engine fuel-air control unit to the fuel reservoir tank. The increased fuel flow due to the return system, results in lower fuel temperatures at the engine inlet and helps to minimize the amount of fuel vapor generated in the fuel lines during high OAT operations.

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7-24 Revision 9

IGNITION AND STARTER SYSTEM

Engine ignition is provided by two engine-driven magnetos, and two spark plugs in each cylinder. The right magneto fires the lower right and upper left spark plugs, and the left magneto fires the lower left and upper right spark plugs. Normal operation is conducted with both magnetos due to the more complete burning of the fuel/air mixture with dual ignition.

Ignition and starter operation is controlled by a rotary-type switch located on the left switch and control panel. The switch is labeled clockwise, OFF, R, L, BOTH, and START. The engine should be operated on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. When the switch is rotated to the spring loaded START position, (with the master switch in the ON position), the starter contactor is closed and the starter, now energized, will crank the engine. When the switch is released, it will automatically return to the BOTH position.

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through an intake on the lower front portion of the engine cowling. The intake is covered by an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an air box. The air box has a spring-loaded alternate air door. If the air induction filter should become blocked, suction created by the engine will open the door and draw unfiltered air from inside the lower cowl area. An open alternate air door will result in an approximate 10% power loss at full throttle. After passing through the air box, induction air enters a fuel/air control unit under the engine, and is then ducted to the engine cylinders through intake manifold tubes.

7-22 Revision 4

Oil pressure signals are generated from an oil pressure line/transducer combination. An oil pressure line is routed from the upper front of the engine case to the rear engine baffle. At the baffle, the oil pressure line is connected to a transducer. This transducer produces an electrical signal which is translated into a pressure reading by the oil pressure gage located on the LH instrument panel.

In addition, a separate low oil pressure indication is provided through the panel annunciator. This annunciator is wired to a pressure switch located on the rear of the engine accessory case. When oil pressure is below 20 PSI, the switch grounds and completes the annunciator circuit, illuminating the red OIL PRESS light. When pressure exceeds 20 PSI, the ground is removed and the OIL PRESS annunciator goes out.

NOTE

The low oil pressure switch is also connected to the hour (Hobbs) meter. When pressure exceeds 20 PSI, a ground is supplied to the hour meter, completing the hour meter circuit.

Oil temperature signals are generated from a resistance-type probe located in the engine accessory case. As oil temperature changes, the probe resistance changes. This resistance is translated into oil temperature readings on the cockpit indicator.

The engine driven mechanical tachometer is located on the instrument panel to the right of the pilot's control wheel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter in the lower section of the dial records elapsed engine time in hours and tenths. Instrument markings include the normal operating range (green arc) from 1900 to 2400 RPM.

The exhaust gas temperature (EGT) indicator is located on the LH instrument panel as part of the EGT/Fuel Flow indicator. Since exhaust gas temperature varies with fuel-air ration (mixture), density altitude, throttle position and RPM, the instrument is a useful aid in adjusting the mixture for best economy or performance. The EGT indicator allows the pilot to lean (reduce the proportion of fuel in the fuel-air mixture) to a known value using the maximum or "peak" exhaust gas temperature as a reference. An index pointer which can be positioned manually is provided for the pilot to mark the location of the peak. Never lean using EGT when operating at more than 80% power.

7-20 Revision 7

NOTE

Accidental opening of a cabin door in flight due to improper closing does not constitute a need to land the airplane. The best procedure is to set up the airplane in a trimmed condition at approximately 75 KIAS, momentarily shove the door outward slightly, and forcefully close and lock the door.

Exit from the airplane is accomplished by rotating the door handle from the LOCK position, past the CLOSE position, aft to the OPEN position and pushing the door open. To lock the airplane, lock the right cabin door with the inside handle, close the left cabin door, and using the ignition key, lock the door.

The left and right cabin doors are equipped with openable windows which are held in the closed position by a detent equipped latch on the lower edge of the window frame. To open the windows, rotate the latch upward. Each window is equipped with a spring-loaded retaining arm which will help rotate the window outward, and hold it there. If required, either window may be opened at any speed up to 163 KIAS. The rear side windows and rear windows are of the fixed type and cannot be opened.

CONTROL LOCKS

A control lock is provided to lock the aileron and elevator control surfaces to prevent damage to these systems by wind buffeting while the airplane is parked. The lock consists of a shaped steel rod and flag. The flag identifies the control lock and cautions about its removal before starting the engine. To install the control lock, align the hole in the top of the pilot's control wheel shaft with the hole in the top of the shaft collar on the instrument panel and insert the rod into the aligned holes. Installation of the lock will secure the ailerons in a neutral position and the elevators in a slightly trailing edge down position. Proper installation of the lock will place the flag over the ignition switch. In areas where high or gusty winds occur, a control surface lock should be installed over the vertical stabilizer and rudder. The control lock and any other type of locking device should be removed prior to starting the engine.

7-18 Feb 28/00

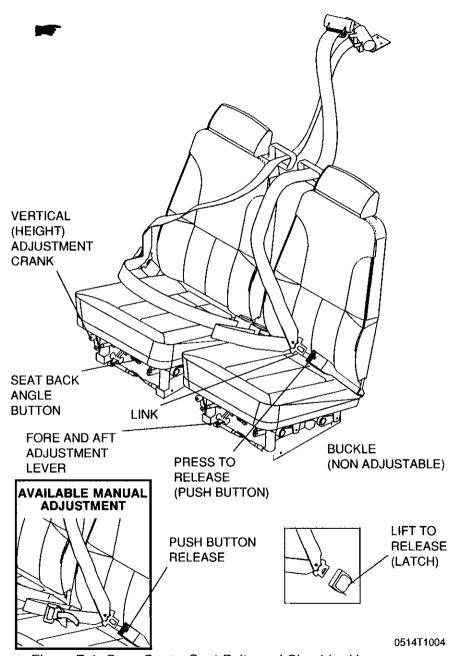


Figure 7-4. Crew Seats, Seat Belts and Shoulder Harnesses

7-16 Revision 8

LANDING GEAR SYSTEM

The landing gear is of the tricycle type, with a steerable nose wheel and two main wheels. Wheel fairings are optional equipment for both the main and nose wheels. Shock absorption is provided by the tubular spring steel main landing gear struts and the air/oil nose gear shock strut. Each main gear wheel is equipped with a hydraulically actuated disc type brake on the inboard side of each wheel.

BAGGAGE COMPARTMENT

The baggage compartment consists of two areas, one extending from behind the rear passengers seat to the aft cabin bulkhead, and an additional area aft of the bulkhead. Access to both baggage areas is gained through a lockable baggage door on the left side of the airplane, or from within the airplane cabin. A baggage net with tiedown straps is provided for securing baggage and is attached by tying the straps to tiedown rings provided in the airplane. For baggage area and door dimensions, refer to Section 6.

SEATS

The seating arrangement consists of two vertically adjusting crew seats for the pilot and front seat passenger, and a single bench seat with adjustable back for rear seat passengers.

Seats used for the pilot and front seat passenger are adjustable fore and aft, and up and down. Additionally, the angle of the seat back is infinitely adjustable.

Fore and aft adjustment is made using the handle located below the center of the seat frame. To position the seat, lift the handle, slide the seat into position, release the handle and check that the seat is locked in place. To adjust the height of the seat, rotate the large crank under the right hand corner of the seat until a comfortable height is obtained. To adjust the seat back angle, pull up on the release button, located in the center front of seat, just under the seat bottom, position the seat back to the desired angle, and release the button. When the seat is not occupied, the seat back will automatically fold forward whenever the release button is pulled up.

7-14 Revision 4

RH PANEL LAYOUT

The RH panel contains the hour meter, ELT switch, and room for expansion of indicators and other avionics equipment. Below this sub panel are the glove box, cabin heat and cabin air controls, and wing flap switch.

CENTER PEDESTAL LAYOUT

The center pedestal, located below the center panel, contains the elevator trim control wheel, position indicator, handheld microphone bracket and fuel shutoff valve control. The fuel selector valve handle is located at the base of the pedestal.

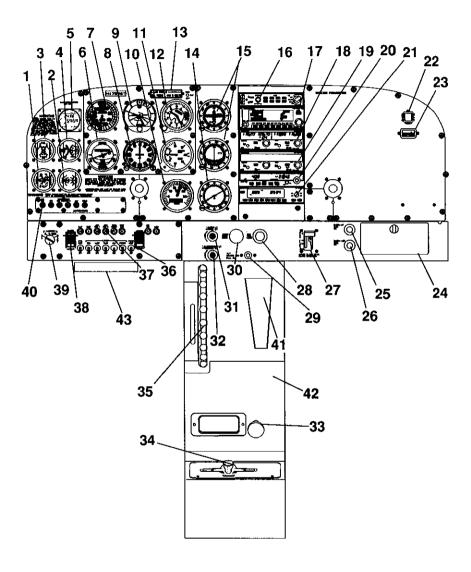
GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 10° each side of center. By applying either left or right brake, the degree of turn may be increased up to 30° each side of center.

Moving the airplane by hand is most easily accomplished by attaching a tow bar to the nose gear strut. If a tow bar is not available, or pushing is required, use the wing struts as push points. Do not use the vertical or horizontal surfaces to move the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel more than 30° either side of center or structural damage to the nose gear could result.

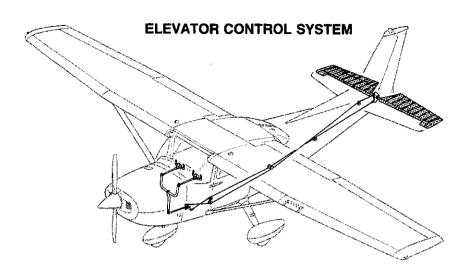
The minimum turning radius of the airplane, using differential braking and nose wheel steering during taxi, is approximately 27 feet. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down on a tailcone bulkhead just forward of the horizontal stabilizer to raise the nose wheel off the ground. Care should be exercised to ensure that pressure is exerted only on the bulkhead area and not on skin between the bulkheads. Pressing down on the horizontal stabilizer is not recommended.

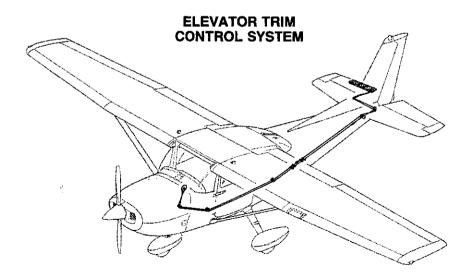
7-12 Revision 7



0585C1040

Figure 7-2. Instrument Panel (Sheet 1 of 2)





0585X1018

Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a spar, formed sheet metal ribs and reinforcements, a wraparound skin panel, formed leading edge skin and a dorsal. The rudder is constructed of a formed leading edge skin and spar with attached hinge brackets and ribs, a center spar, a wrap around skin, and a ground adjustable trim tab at the base of the trailing edge. The top of the rudder incorporates a leading edge extension which contains a balance weight.

The horizontal stabilizer is constructed of a forward and aft spar, ribs and stiffeners, center, left, and right wrap around skin panels, and formed leading edge skins. The horizontal stabilizer also contains the elevator trim tab actuator.

Construction of the elevator consists of formed leading edge skins, a forward spar, aft channel, ribs, torque tube and bellcrank, left upper and lower "V" type corrugated skins, and right upper and lower "V" type corrugated skins incorporating a trailing edge cutout for the trim tab. The elevator tip leading edge extensions incorporate balance weights. The elevator trim tab consists of a spar, rib, and upper and lower "V" type corrugated skins.

FLIGHT CONTROLS

The airplane's flight control system (Refer to Figure 7-1) consists of conventional aileron, rudder, and elevator control surfaces. The control surfaces are manually operated through cables and mechanical linkage using a control wheel for the ailerons and elevator, and rudder/brake pedals for the rudder.

TRIM SYSTEM

A manually operated elevator trim system is provided (Refer to Figure 7-1). Elevator trimming is accomplished through the elevator trim tab by utilizing the vertically mounted trim control wheel in the cockpit. Forward rotation of the trim wheel will trim nose down; conversely, aft rotation will trim nose up.

TABLE OF CONTENTS (Continued)

	Page
Engine	7-19
Engine Controls	7-19
Engine Instruments	7-19
New Engine Break In And Operation	7-21
Engine Lubrication System	7-21
Ignition And Starter System	7-22
Air Induction System	7-22
Exhaust System	7-23
Cooling System	7-23
Propeller	7-23
Fuel System	7-23
Fuel Distribution	7-24
Fuel Indicating	7-25
Fuel Venting	7-26
Reduced Tank Capacity	7-26
Fuel Selector Valve	7-26
Fuel Drain Valves	7-28
Brake System	7-29
Electrical System	
Annunciator Panel	
Master Switch	
Avionics Master Switch	
Ammeter	
Low Voltage Annunciation	
Circuit Breakers And Fuses	
Ground Service Plug Receptacle	7-35

7-2 Feb 28/00

ITEM	EQUIPMENT LIST DESCRIPT	ION REF DRAWIN	G WT	ARM INS.	
No.		3930404-1	4.1*	18.7*	_1
34-12-S	MODE C TRANSPONDER INSTL	066-01156-01		13.5	- 1
34-12-3	VT 76C TRANSPUNDER	l	0.8	10.9	l
	TRANS CAL BLIND ENCODER	3960191-1	0.2	85.3	- }
}		10000	0.6	28.9	l
	WADE AND CARLE AS		15.3*	84.1	• }
	LAWRING MATERIAL AND A COMPANY	DL 114015 (42-1	19.5	1	1
34-13-0	(NET WT INCREASE) (REQUIRED	37-01-S) 066-03046-0	107 3.4	13.4	.
	LICENDICATOR	1	nns 0.3	15.8	
i i	L SAMO OLAVING ACCESSOR	3	0.7	52.6	;
į		LI ASSISCE POR COLOR	5.1	112	.5
	DEMOTE DIRECTION GINO		1.6	117	.0
	- NAV CONVERTER INSTL		8.0	60.1	7
	- WIRING	3900016	-13.0		Ì
	ATO GVEO INSTL (REMOVI	ED) 0501135	11.0	1	i
l	- GYRO INSTL FOR HSI INST	ALLED 0501171-1	-1.2	' []	
	- REMOVE #1 NAV INDICATO	n l	'''	.	_
i i	37 - VACUUM	\	1	- 1	
	37 - VACOOM	CAL DUAL	5.4		-
37-01-5	VACUUM SYSTEM, ENGINE DRIV	F 211CC E211CC	1.9	- 1	-
10,01	I AND INTO A PROCESSION	L Z 1 100	1.5		
	THE PROPERTY OF THE PROPERTY O	E E 12 O	0.		
l l			Ì 0.		
1	L COOLING SHROUD, AIRD	1201075-2	0.		-
ł	TER INSTALLATION	10-000 4) o.	3 14	4.3
l l	VACUUM GAGE/AMMETE	2H3-48	0	.3 4	.8
	- VACUUM RELIEF VALVE	1H5-25	l o	.5 -0).2
4	- MANIFOLD	S3280-1	\ 0	.3 1	4.3
37-02	1	L.	, lo	.0 1	6.0
37-02		T, VACUUM DS08000	`\	1	
37-03	PUMP	1	1	1	
Ti.	53 - FUSELAGE				16.3
53-01	S REFUELING STEPS AND HAND	DLE INSTL 0513415	2	1.7	10.5
) cc. WINDOWS	i !	40	5.8*	48.5*
	-S WINDOW, HINGED RIGHT DOG	OR, OPENABLE 0517001	-40	J.V [48.5*
56-0		R, OPENABLE 0517001	-39	0.0	.,,,,,
56-0	-R WINDOW, HINGED LET 7 50 - WINGS	\	\	Ì	
		OMBI NET	1		
57-0	1-0 HEAVY DUTY FLAPS, (WT SH	OWN, NET	Ì		
5/-0	1 OLINO)		2	2.2	83.2
	TWO (2) FLAPS (EXCHA	(NGED)		1.1	83.2
	- ONE (1) FLAP (EXCHAN	IGEU)BOLOGO			

Figure 6-9. Equipment List Description (Sheet 5 of 7)

ITEM	EQUIPMENT LIST DESCRIPTION	REF DRAWING	**	ARM INS.
No.		0500832-1	1.2	50.0
5-18-R			1	
	APPROVED AIRPLANE FLIGHT MANUAL (STOWED IN PILOT'S SEAT BACK CASE)	<u> </u>	1	_
İ	(STOWED IN PILOTS SEAT BACK CASE)	S2107-1	0.1	14.3
25-19-S	FUEL SAMPLING CUP	0501019-1	1.7	124.0
25-20-S	TOW BAR, NOSE GEAR (STOWED)	3940401-1	3.1*	101.0*
25-21-R	EMERGENCY LOCATOR TRANSMITTER			
ļ	INSTL	3940401-1	1.8	113.3
	- ELT TRANSMITTER 3000-11	3940401-1	0.5	122.0
	- ANTENNA AND CABLE ASSY, 3003-45	3940401-1	0.1	118.3
	- HARDWARE	00.00	1	
	26 - FIRE PROTECTION		- 0+	43.8*
	FIRE EXTINGUISHER INSTALLATION	0501011-2	5.3*	44.0
26-01-S	- FIRE EXTINGUISHER	C421001-0201	4.8	44.0
	- MOUNTING CLAMP	C421001-0202	0.5	42.2
	- MOUNTING OLAWI	1	1	1
	27 - FLIGHT CONTROLS	0506008-1	5.5*	12.4*
27-01-S	DUAL CONTROLS INSTL, RIGHT SEAT		2.0	26.0
21-01-0	CONTROL WHEEL, RH	0513576-2	11	6.8
	BUDDER & BRAKE PEDAL INSTE, HH	0510402-16	0.2	22.0
27-02-S	MICHT AND MICH	0560059-1 D	0.2	
	28 - FUEL		1	
	FUEL QUANTITY INDICATORS, LEFT & RIGH	IT S3281-1	0.4	14.4
28-01-F	FUEL QUANTITY INDICATORS, LEFT & THOM	5100-00-1	1.9	9.5
28-02-F	AUXILIARY FUEL PUMP			
1	31 - INDICATING/RECORDING SYSTEM		0.7	16.5
1 04 04 0	CLOCK/OAT INDICATOR, DIGITAL	M803B-2-0	***	
31-01-9		C664503-0103		" .
31-02-		90-44001-1	0.5	1
31-03-	1 NIDICATOR PNELIMALIL	0523112-2	0.4	20.5
31-04-	32 - LANDING GEAR	1	1	
ŀ		0541200-7,-8	34.4	57.8
32-01-	R WHEEL BRAKE AND TIRE, 6.00 X 6 MAIN	C163001-0104		_
"-"	WHEEL ASSY, CLEVELAND (EACH)	C163030-011	'	1
1	BRAKE ASSY, CLEVELAND (EACH)	C262003-010	1 7.9	1
1	- TIRE, 4-PLY BLACKWALL (EACH)			1
ŀ	- TUBE (EACH)	C262023-010		

Figure 6-9. Equipment List Description (Sheet 3 of 7)

6-20 Revision 7

ITEM No.	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS.
	11 - PLACARDS AND MARKINGS	i		أمما
}	IFR DAY & NIGHT LIMITATIONS PLACARD	0505087-3	0.0	43.0
11-01-R	PAINT, OVERALL EXTERIOR	0504051	19.2*	95.4*
11-02-5	- OVERALL WHITE		18.4	93.6
ļ	- COLORED STRIP DECALS	1	0.8	135.9
Į	21 - AIR CONDITIONING			
		0513575-1	1.7	60.0
21-01-5	REAR SEAT AIR VENTS	0554001-9	2.5	-4.0
21-02-S	CABIN HEATER SYSTEM			1
	22 - AUTO FLIGHT	00470 0600	8.6*	36.8"
22-02-A	SINGLE AXIS AUTO-PILOT (KAP 140)	065-00176-2602	2.6	12.4
22-02-1	I ALITO-PILOT COMPUTER	065-00179-0300	3.6	68.5
	DEPOIL ACTUATOR, WITH MOUNT	1	0.5	14.0
ł	-DIRECTIONAL GYRO (EXCHANGE)	Ì	0.5	12.0
1	-CONFIGURATION MODULE		1.4	20.8
1	-CABLE ASSEMBLY	1	'	
l	23 - COMMUNICATIONS	1	١.,	143.2
	WICKS (SET OF 10)	0501048-1	0.4	
23-01-S	LIANTOCKA #4 INSTALLATION NO GO	3930404-1	7.9*	
23-02-\$	- KX 155A BENDIX/KING NAV/COM w/ GS	066-01032-0201	3.5	1
ł	- KI 208 NAV INDICATOR	1000-00000 000-	1.0	
1	- VHF COM ANTENNA	3960113-8	0.5	T 1
Į.	- COM ANTENNA CABLE	3921100-1	0.5	1
	OMNI NAV ANTENNA	}	1.5	1
	OMNI ANTENNA CO-AX CABLE		0.5	1
1	HARDWARE AND CABLE ASSEMBLY	3921100-1	6.5	
23-03-/	NAVICOM INSTALLATION WITH GS	3930404-1	_	1 1 2
23-03-7	- KX 155A BENDIX/KING NAV/COM	066-01032-020	' ~~	,
	w/GS	066-03056-000	2 1.2	13.9
1	- KI 209 NAV INDICATOR	3960113-9	0.5	61.2
1	- VHF ANTENNA	3930403-1	0.3	2 14.0
1	- ANTENNA COUPLER		0.5	2 3.5
1	- HARDWARE AND CABLE ASSEMBLY	002.113	0.	4 26.5
	- CO-AX, COM ANTENNA	3900003-1	2.9	-
23-04-	S AUDIO/INTERCOM/MARKER BEACON INSTI	066-01155-01	01 1.	7 14.8
	- KMA 26 AUDIO SWITCH PANEL		0.	.8 30.0
ŀ	- HARDWARE AND CABLE ASSEMBLY		11	.3* 27.4
23-05	S BASIC AVIONICS (USED WITH #1 NAV/COM	3960188-1	0	.5 130
1	- MARKER BEACON ANTENNA		7	.9 26.5
1	- FUSELAGE AUDIO WIRING	1	0	.2 18.0
1	- MICROPHONE - HANDHELD	1	1 -	.2 6.5
1	- AVN COOLING FAN INSTL - BASIC CIRCUIT BREAKER PANEL	3930417		.4 16.

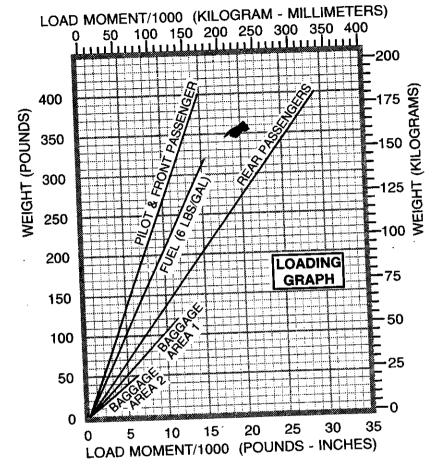
Figure 6-9. Equipment List Description (Sheet 1 of 7)

CESSNA MODEL 172R

AIRPLANE C.G. LOCATION - MILLIMETERS AFT OF DATUM (STA. 0.0) 25 975 1025 1075 1125 1175 1225 950 | 1000 | 1050 | 1100 | 1150 | 1200 | 2500 1100 CENTER OF GRAVITY LIMITS 2400 (KILOGRAMS) LOADED AIRPLANE WEIGHT (POUNDS) 2300 2200 LOADED AIRPLANE WEIGHT 950 2100 900 2000 NORMAL CATEGORY UTILITY CATEGORY 850 1900 800 1800 1700 750 1600 700 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 1500 AIRPLANE C.G. LOCATION - INCHES AFT OF DATUM (STA 0.0)

0585C1008

Figure 6-8. Center of Gravity Limits



NOTE: LINE REPRESENTING ADJUSTABLE SEATS SHOWS THE PILOT OR PASSENGER CENTER OF GRAVITY ON ADJUSTABLE SEATS POSITIONED FOR AN AVERAGE OCCUPANT. REFER TO THE LOADING ARRANGEMENTS DIAGRAM FOR FORWARD AND AFT LIMITS OF OCCUPANT C.G. RANGE.

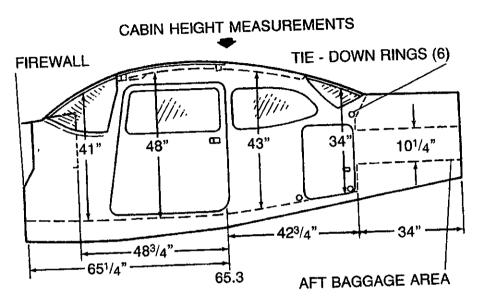
0585C1006

Figure 6-6. Loading Graph

	W	IGHT AN	D MOME ATION	NT
ITEM DESCRIPTION	SAN AIRP	IPLE LANE	YC AIRP	UR LANE
	Weight (lbs.)	Moment (Lb-ins. /1000)	Weight (lbs.)	Moment (Lb-ins. /1000)
 Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil) 	1639	64.4		
2. Usable Fuel (At 6 Lbs./Gal.)			ļ	<u> </u>
53 Gallons Maximum	<u> </u>	<u> </u>	<u> </u>	<u> </u>
35 Gallons (To reduced fuel indicator tab)	210	10.1		
3. Pilot and Front Passenger (Station 34 to 46)	340	12.6		
4. Rear Passengers	220	16.0		
5. *Baggage Area 1 (Station 82 to 108; 120 Lbs. Max.)				
	48	3.4	/	
6. *Baggage Area 2 (Station 108 to 142; 50 Lbs. Max.)	ו			
7. RAMP WEIGHT AND MOMENT (add columns)	2457	106.5		
8. Fuel allowance for engine start, taxi and runup	-7.0	-0.3		
9. TAKEOFF WEIGHT AND MOMENT (Subtract Ste 8 from Step 7)	p 2450			
10. Locate this point (2450 Moment Envelope, an envelope, the loading	ia since t	UIS DOILL	Center of falls with	

envelope, the loading is acceptable.
The maximum allowable combined weight capacity for baggage areas 1 and 2 is 120 pounds.

Figure 6-5. Sample Loading Problem (Sheet 1 of 2)



DOOR OPENING DIMENSIONS

		WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (REAR)
F	CABIN DOORS	321/2"	37"	401/2"	39"
	BAGGAGE DOOR	151/4"	15 ¹ / ₄ "	22"	21"

0585X1023

Figure 6-4. Internal Cabin Dimensions (Sheet 1 of 2)

Feb 28/00

NOTE

Loading Graph information for the pilot, passengers and baggage is based on seats positioned for average occupants and baggage loaded in the center of the baggage areas as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft C.G. range limitations (seat travel and baggage area limitation). Additional moment calculations, based on the actual weight and C.G. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph.

Total the weights and moments/1000 and plot these values on the Center of Gravity Moment Envelope to determine whether the point falls within the envelope, and if the loading is acceptable.

BAGGAGE TIE-DOWN

A nylon baggage net having tie-down straps is provided as standard equipment to secure baggage on the cabin floor aft of the rear seat (baggage area 1) and in the aft baggage area (baggage area 2). Six eyebolts serve as attaching points for the net. Two eyebolts for the forward tie-down straps are mounted on the cabin floor near each sidewall just forward of the baggage door approximately at station 90; two eyebolts are installed on the cabin floor slightly inboard of each sidewall approximately at station 107; and two eyebolts are located below the aft window near each sidewall approximately at station 107. A placard on the baggage door defines the weight limitations in the baggage areas.

When baggage area 1 is utilized for baggage only, the two forward floor mounted eyebolts and the two aft floor mounted eyebolts (or the two eyebolts below the aft window) may be used, depending on the height of the baggage. When baggage is carried in the baggage area 2 only, the aft floor mounted eyebolts and the eyebolts below the aft window should be used. When baggage is loaded in both areas, all six eyebolts should be utilized.

Feb 28/00

3. Weighing:

- a. Weigh airplane in a closed hangar to avoid errors caused by air currents.
- b. With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

4. Measuring:

- a. Obtain measurement A by measuring horizontally (along the airplane centerline) from a line stretched between the main wheel centers to a plumb bob dropped from the firewall.
- b. Obtain measurement B by measuring horizontally and parallel to the airplane centerline, from center of nose wheel axle, left side, to a plumb bob dropped from the line between the main wheel centers. Repeat on right side and average the measurements.
- 5. Using weights from item 3 and measurements from item 4, the airplane weight and C.G. can be determined.
- 6. Basic Empty Weight may be determined by completing Figure 6-1.

WEIGHT AND BALANCE

The following information will enable you to operate your Cessna within the prescribed weight and center of gravity limitations. To calculate weight and balance, use the Sample Loading Problem, Loading Graph, and Center of Gravity Moment Envelope as follows:

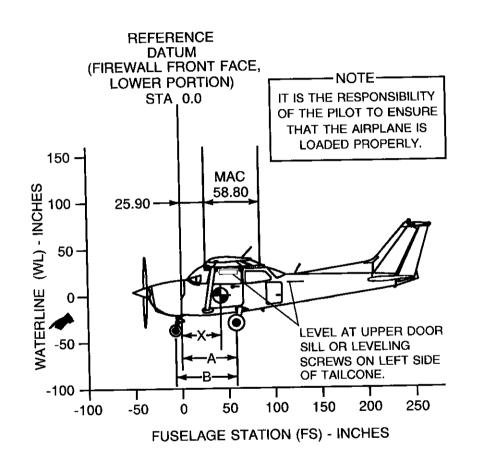
Take the basic empty weight and moment from appropriate weight and balance records carried in your airplane, and enter them in the column titled YOUR AIRPLANE on the Sample Loading Problem.

NOTE

In addition to the basic empty weight and moment noted on these records, the C.G. arm (fuselage station) is also shown, but need not be used on the Sample Loading Problem. The moment which is shown must be divided by 1000 and this value used as the moment/1000 on the loading problem.

Use the Loading Graph to determine the moment/1000 for each additional item to be carried; then list these on the loading problem.

AIRPLANE WEIGHING FORM

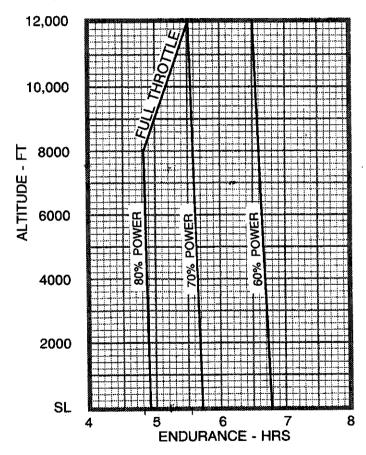


0585C1010

Figure 6-1. Airplane Weighing Form (Sheet 1 of 2)

ENDURANCE PROFILE 45 MINUTES RESERVE 53 GALLONS USABLE FUEL

CONDITIONS: 2450 Pounds Recommended Lean Mixture for Cruise At All Altitudes Standard Temperature



NOTE:

1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb.



Figure 5-10. Endurance Profile

CRUISE PERFORMANCE

CONDITIONS: 2450 Pounds

Recommended Lean Mixture At All Altitudes (Refer to Section 4, Cruise)

PRESS	0014		C BELC			ANDAI IPERAT			°C ABO DARD	
ALT FT	RPM	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
8000	2400	-			80	122	9.2	76	121	8.7
	2350	81	120	9.3	76	119	8.7	71	118	8.2
	2300	76	117	8.7	71	116	8.2	68	115	7.8
	2200	68	111	7.7	64	110	7.3	61	107	7.0
	2100	60	104	6.9	57	102	6.6	55	99	6.4
	2000	54	96	6.2	52	94	6.0	51	91	5.9
		•								
10,000	2350	76	119	8.8	72	118	8.2	68	117	7.8
	2300	72	116	8.3	68	115	7.8	65	113	7.4
	2250	68	113	7.8	65	112	7.4	61	109	7.1
	2200	65	110	7.4	61	108	7.0	59	105	6.7
	2100	58	102	6.6	55	100	6.4	54	97	6.2
	2000	52	94	6.1	51	91	5.9	50	88	5.8
:										
12,000	2350	73	119	8.3	69	117	7.9	65	115	7.5
	2300	69	115	7.9	65	113	7.5	62	111	7.1
	2250	65	112	7.5	62	109	7.1	59	107	6.8
	2200	62	108	7.1	59	105	6.8	57	103	6.6
	2100	56	100	6.4	54	97	6.2	53	94	6.1

NOTE:

1. Cruise speeds are shown for an airplane equipped with speed fairings. Without speed fairings, decrease speeds shown by 2 knots.

Figure 5-8. Cruise Performance (Sheet 2 of 2)

5-18 Dec 2/96

TIME, FUEL AND DISTANCE TO CLIMB AT 2450 POUNDS

CONDITIONS:

Flaps Up Full Throttle Standard Temperature

PRESS		CUMB	RATE	FRO	M SEA LI	EVEL
ALT FT	TEMP °C	CLIMB SPEED KIAS	OF CLIMB FPM	TIME IN MIN	FUEL USED GAL	DIST NM
S.L.	15	79	720	0	0.0	0
1000	13	78	670	1	0.4	2
2000	11	77	625	3	0.7	4
3000	9	76	575	5	1.2	6
4000	7	76	560	6	1.5	8
5000	5	75	515	8	1.8	11
6000	3	74	465	10	2.1	14
7000	1	73	415	13	2.5	17
8000	-1	72	365	15	3.0	21
9000	-3	72	315	18	3.4	25
10,000	-5	71	270	22	4.0	29
11,000	-7	70	220	26	4.6	35
12,000	-9	69	170	31	5.4	43

NOTES:

- Add 1.1 gallons of fuel for engine start, taxi and takeoff allowance.
 Mixture leaned above 3000 feet for maximum RPM.
 Increase time, fuel and distance by 10% for each 10°C above standard temperature.
- Distances shown are based on zero wind.

Figure 5-7. Time, Fuel and Distance to Climb

SHORT FIELD TAKEOFF DISTANCE AT 2450 POUNDS

CONDITIONS:

Flaps 10° Full Throttle Prior to Brake Release Paved, level, dry runway Zero Wind Lift Off: 51 KIAS Speed at 50 Ft: 57 KIAS

		°C	10	°C	20°C		30°C		40°C	
Press Alt In Feet	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst		Total Ft To Clear 50 Ft Obst		Total Ft To Clear 50 Ft Obst	Roll	Total Ft To Clear 50 Ft Obst
S. L.	845	1510	910	1625	980	1745	1055	1875	1135	2015
1000	925	1660	1000	1790	1075	1925	1160	2070	1245	2220
2000	1015	1830	1095	1970	1185	2125	1275	2290	1365	2455
3000	1115	2020	1205	2185	1305	2360	1400	2540	1505	2730
4000	1230	2245	1330	2430	1435	2630	1545	2830	1655	3045
5000	1355	2500	1470	2715	1585	2945	1705	3175	1830	3430
6000	1500	2805	1625	3060	1750	3315	1880	3590	2020	3895
7000	1660	3170	1795	3470	1935	3770	2085	4105	2240	4485
8000	1840	3620	1995	3975	2150	4345	2315	4775		

NOTES:

- 1. Short field technique as specified in Section 4.
- Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
- 3. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
- 4. For operation on dry, grass runway, increase distances by 15% of the "ground roll" figure.
- 5. Where distance value has been deleted, climb performance is minimal.

Figure 5-5. Short Field Takeoff Distance

STALL SPEEDS AT 2450 POUNDS

Conditions: Power Off

MOST REARWARD CENTER OF GRAVITY

	ANGLE OF BANK											
FLAP SETTING	C)°	3	0°	4	5°	60°					
	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS				
UP 10° 30°	44 35 33	51 48 47	48 38 36	55 52 50	53 42 40	61 58 56	63 50 47	73 69 66				

MOST FORWARD CENTER OF GRAVITY

		ANGLE OF BANK											
FLAP SETTING)°	3	0° .	4	5°	60°						
	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS					
UP	44	52	48	56	53	62	63	74					
10°	37	50	40	53	44	59	53	70					
30°	33	47	36	50	40	56	47	66					

NOTES:

- Altitude loss during a stall recovery may be as much as 230 feet.
 KIAS values are approximate.

Figure 5-3. Stall Speeds

AIRSPEED CALIBRATION ALTERNATE STATIC SOURCE

HEATER OFF, VENTS AND WINDOWS CLOSED

FLAPS UP							•				
NORMAL KIAS	50	60	70	80	90	100	110	120	130	140	
ALTERNATE KIAS	51	61	71	82	91	101	111	121	131	141	
FLAPS 10°											
NORMAL KIAS	40	50	60	70	80	90	100	110			
ALTERNATE KIAS	40	51	61	71	81	90	99	108			
FLAPS 30°			······································								,
NORMAL KIAS	40	50	60	70	80	85					
ALTERNATE KIAS	38	50	60	70	79	81					

HEATER ON, VENTS OPEN AND WINDOWS CLOSED

FLAPS UP											
NORMAL KIAS	40	50	60	70	80	90	100	110	120	130	140
ALTERNATE KIAS	36	48	59	70	80	89	99	108	118	128	139
FLAPS 10°											
NORMAL KIAS	40	50	60	70	80	90	100	110			
ALTERNATE KIAS	38	49	59	69	79	88	97	106			
FLAPS 30°						_					
NORMAL KIAS	40	50	60	70	80	85				- 	
ALTERNATE KIAS	34	47	57	67	77	81					

WINDOWS OPEN

FLAPS UP											
NORMAL KIAS	40	50	60	70	80	90	100	110	120	130	140
ALTERNATE KIAS	26	43	57	70	82	93	103	113	123	133	143
FLAPS 10°										,	
NORMAL KIAS	40	50	60	70	80	90	100	110			
ALTERNATE KIAS	25	43	57	69	80	91	101	111			
FLAPS 30°									•		-
NORMAL KIAS	40	50	60	70	80	85		~	<i>-</i>		
ALTERNATE KIAS	25	41	54	67	78	84					

Figure 5-1. Airspeed Calibration (Sheet 2 of 2)

5-10 Dec 2/96

LANDING

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-11 presents landing distance information for the short field technique. The distances corresponding to 2000 feet and 30°C are as follows:

Ground roll 625 Feet Total distance to clear a 50-foot obstacle 1410 Feet

A correction for the effect of wind may be made based on Note 2 of the landing chart, using the same procedure as outlined for takeoff.

DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for this airplane with an outside air temperature 23°C above standard. This is not to be considered as an operating limitation. Reference should be made to Section 2 for engine operating limitations.

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in Figure 5-7 and Figure 5-8. For this sample problem, Figure 5-7 shows that a climb from 2000 feet to 6000 feet requires 1.4 gallons of fuel. The corresponding distance during the climb is 10 nautical miles. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard (28°C - 12°C), the correction would be:

$$\frac{16^{\circ}\text{C}}{10^{\circ}\text{C}}$$
 X 10% = 16% Increase

• With this factor included, the fuel **estimate** would be calculated as follows:

Fuel to climb, standard temperature	1.4
Increase due to non-standard temperature	<u>0.2</u>
(1.4 X 16%)	

Corrected fuel to climb

1.6 Gallons

Using a similar procedure for the distance to climb results in 12 nautical miles. (10 nm using chart + 1.2 nm to correct for higher than standard temperature = 11.2 nm. Rounded up to 12 nm.)

CRUISE CONDITIONS:

320 Nautical Miles Total distance

Pressure altitude 5500 Feet **Temperature** 20°C

Expected wind enroute 10 Knot Headwind

LANDING CONDITIONS:

Field pressure altitude 2000 Feet Temperature 25°C Field length 3000 Feet

TAKEOFF

SECTION 5

The takeoff distance chart, Figure 5-5, should be consulted, keeping in mind that distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 2450 pounds, pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll 1275 Feet Total distance to clear a 50-foot obstacle 2290 Feet

These distances are well within the available takeoff field length. However, a correction for the effect of wind may be made based on Note 3 of the takeoff chart. The correction for a 12 knot headwind is:

This results in the following distances, corrected for wind:

Ground roll, zero wind 1275 Decrease in ground roll -166

(1275 feet X 13%)

Corrected ground roll 1109 Feet

HOT WEATHER OPERATION

Refer to the general warm temperature starting information under Starting Engine in this section. Avoid prolonged engine operation on the ground.

NOISE CHARACTERISTICS AND NOISE REDUCTION

The certificated noise level for the Model 172R at 2450 pounds maximum weight is 73.3 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

The following procedures are suggested to minimize the effect of airplane noise on the public:

- Pilots operating airplanes under VFR over outdoor assemblies
 of persons, recreational and park areas, and other noise
 sensitive areas should make every effort to fly not less than
 2000 feet above the surface, weather permitting, even though
 flight at a lower level may be consistent with the provisions of
 government regulations.
- 2. During departure from or approach to an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near noise sensitive areas.

NOTE

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary to adequately exercise the duty to see and avoid other airplanes.

4-36 Revision 7

COLD WEATHER OPERATION

Special consideration should be given to the operation of the airplane fuel system during the winter season or prior to any flight in cold temperatures. Proper preflight draining of the fuel system is especially important and will eliminate any free water accumulation. The use of additives such as isopropyl alcohol or diethylene glycol monomethyl ether may also be desirable. Refer to Section 8 for information on the proper use of additives.

Cold weather often causes conditions which require special care during airplane operations. Even small accumulations of frost, ice, or snow must be removed, particularly from wing, tail and all control surfaces to assure satisfactory flight performance and handling. Also, control surfaces must be free of any internal accumulations of ice or snow.

If snow or slush covers the takeoff surface, allowance must be made for takeoff distances which will be increasingly extended as the snow or slush depth increases. The depth and consistency of this cover can, in fact, prevent takeoff in many instances.

A WARNING

WHEN PULLING THE PROPELLER THROUGH BY HAND, TREAT IT AS IF THE IGNITION SWITCH IS TURNED ON. A LOOSE OR BROKEN GROUND WIRE ON EITHER MAGNETO COULD CAUSE THE ENGINE TO FIRE.

Prior to starting on cold mornings, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy.

When air temperatures are below 20°F (-6°C), the use of an external preheater and an external power source are recommended whenever possible to obtain positive starting and to reduce wear and abuse to the engine and electrical system. Preheat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator may be referred to for this information.

Variations in basic airplane rigging or in weight and balance due to installed equipment or right seat occupancy can cause differences in behavior, particularly in extended spins. These differences are normal and will result in variations in the spin characteristics and in the spiraling tendencies for spins of more than 2 turns. However, the recovery technique should always be used and will result in the most expeditious recovery from any spin.

Intentional spins with flaps extended are prohibited, since the high speeds which may occur during recovery are potentially damaging to the flap/wing structure.

LANDING

NORMAL LANDING

Normal landing approaches can be made with power on or power off with any flap setting desired. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds. Steep slips should be avoided with flap settings greater than 20° due to a slight tendency for the elevator to oscillate under certain combinations of airspeed, sideslip angle, and center of gravity loadings.

Actual touchdown should be made with power off and on the main wheels first to reduce the landing speed and subsequent need for braking in the landing roll. The nose wheel is lowered to the runway gently after the speed has diminished to avoid unnecessary nose gear loads. This procedure is especially important in rough or soft field landings.

4-32 Revision 7

STALLS

The stall characteristics are conventional and aural warning is provided by a stall warning horn which sounds between 5 and 10 knots above the stall in all configurations.

Power off stall speeds at maximum weight for both forward and aft C.G. positions are presented in Section 5.

SPINS

Intentional spins are approved when the airplane is operated in the utility category. Spins with baggage loadings or occupied rear seat(s) are not approved.

However, before attempting to perform spins several items should be carefully considered to assure a safe flight. No spins should be attempted without first having received dual instruction both in spin entries and spin recoveries from a qualified instructor who is familiar with the spin characteristics of the Cessna 172R.

The cabin should be clean and all loose equipment (including the microphone and rear seat belts) should be stowed or secured. For a solo flight in which spins will be conducted, the copilot's seat belt and shoulder harness should also be secured. Care should be taken to ensure that the pilot can easily reach the flight controls and produce maximum control travels.

It is recommended that, where feasible, entries be accomplished at high enough altitude that recoveries are completed 4000 feet or more above ground level. At least 1000 feet of altitude loss should be allowed for a 1-turn spin and recovery, while a 6-turn spin and recovery may require somewhat more than twice that amount. For example, the recommended entry altitude for a 6-turn spin would be 6000 feet above ground level. In any case, entries should be planned so that recoveries are completed well above the minimum 1500 feet above ground level required by FAR 91.303. Another reason for using high altitudes for practicing spins is that a greater field of view is provided which will assist in maintaining pilot orientation.

NOTE

The EGT indicator requires several seconds to respond to mixture adjustments and changes in exhaust gas temperature. More rapid changes in EGT indication are neither necessary nor desirable. Determining peak EGT and setting the desired mixture should take approximately one minute when the adjustments are made sufficiently slowly and accurately.

FUEL SAVINGS PROCEDURES FOR FLIGHT TRAINING OPERATIONS

For best fuel economy during flight training operations, the following procedures are recommended.

- After engine start and for all ground operations, set the throttle to 1200 RPM and lean the mixture for maximum RPM. Leave the mixture at this setting until beginning the BEFORE TAKEOFF checklist. After the BEFORE TAKEOFF checklist is complete re-lean the mixture as described above until ready for the TAKEOFF checklist.
- Lean the mixture for maximum RPM during full throttle climbs above 3000 feet. The mixture may remain leaned (maximum RPM at full throttle) for practicing maneuvers such as stalls and slow flight.
- Lean the mixture for maximum RPM during all operations at any altitude, including those below 3000 feet, when using 80% or less power.

NOTE

- When cruising or maneuvering at 80% or less power, the mixture may be further leaned until the EGT indicator needle peaks and is then enrichened 50°F. This is especially applicable to cross-country training flights, but should be practiced during transition flight to and from the practice area as well.
- Using the above recommended procedures can provide fuel savings in excess of 5% when compared to typical training operations at full rich mixture. In addition, the above procedures will minimize spark plug fouling since the reduction in fuel consumption results in a proportional reduction in tetraethyl lead passing through the engine.

4-28 Revision 7

CRUISE

Normal cruise is performed between 60% and 80% power. The engine RPM and corresponding fuel consumption for various altitudes can be determined by using the data in Section 5.

NOTE

Cruising should be done at 80% power as much as practicable until a total of 50 hours has accumulated or oil consumption has stabilized. Operation at this higher power will ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The Cruise Performance charts in Section 5 provide the pilot with detailed information concerning the cruise performance of the Model 172R in still air. Power and altitude, as well as winds aloft, have a strong influence on the time and fuel needed to complete any flight.

The Cruise Performance Table, Figure 4-3, illustrates the true airspeed and nautical miles per gallon during cruise for various altitudes and percent powers, and is based on standard conditions and zero wind. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip. The selection of cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

In addition to power settings, proper leaning techniques also contribute to greater range and are figured into cruise performance tables. To achieve the recommended lean mixture fuel consumption figures shown in Section 5, the mixture should be leaned using the exhaust gas temperature (EGT) indicator as noted.

NOTE

At lower power it may be necessary to richen the mixture slightly to obtain smooth operation.

LANDING LIGHTS

If landing lights are to be used to enhance the visibility of the airplane in the traffic pattern or enroute, it is recommended that only the taxi light be used. This will extend the service life of the landing light appreciably.

TAKEOFF

POWER CHECK

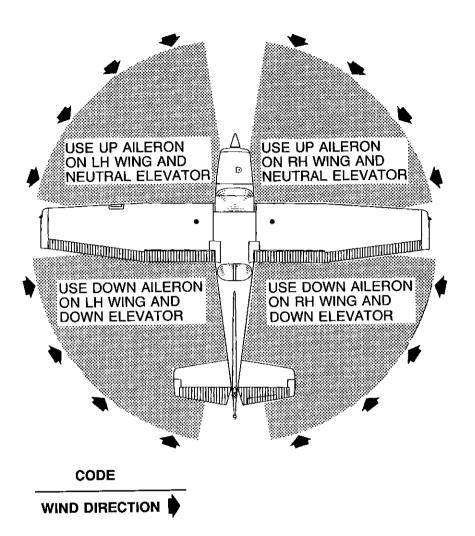
It is important to check full throttle engine operation early in the takeoff roll. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff. If this occurs, you are justified in making a thorough full throttle static runup before another takeoff is attempted. The engine should run smoothly and turn approximately 2065 - 2165 RPM with mixture leaned to provide maximum RPM.

Full throttle run ups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it. When unavoidable small dents appear in the propeller blades, they should be immediately corrected as described in Section 8 under Propeller Care.

Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.

After full throttle is applied, adjust the throttle friction lock clockwise to prevent the throttle from creeping back from a maximum power position. Similar friction lock adjustments should be made as required in other flight conditions to maintain a fixed throttle setting.

4-24 Revision 7



NOTE

Strong quartering tail winds require caution. Avoid sudden bursts of the throttle and sharp braking when the airplane is in this situation. Use the steerable nose wheel and rudder to maintain direction.

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Figure 4-2. Taxiing Diagram

4-22 Revision 7

Should the engine tend to die after starting, turn on the auxiliary fuel pump temporarily and adjust the throttle and/or mixture as necessary to keep the engine running. In the event of over priming or flooding, turn off the auxiliary fuel pump, open the throttle from 1/2 to full open, and continue cranking with the mixture full lean. When the engine starts, smoothly advance the mixture control to full rich and retard the throttle to desired idle speed.

If the engine is under primed (most likely in cold weather with a cold engine) it will not start at all, and additional priming will be necessary.

After starting, if the oil pressure gage does not begin to indicate pressure within 30 seconds in the summer time and approximately one minute in very cold weather, stop the engine and investigate. Lack of oil pressure can cause serious engine damage.

NOTE

Additional details concerning cold weather starting and operation may be found under COLD WEATHER OPERATION paragraphs in this section.

RECOMMENDED STARTER DUTY CYCLE

Crank the starter for 10 seconds followed by a 20 second cool down period. This cycle can be repeated two additional times, followed by a ten minute cool down period before resuming cranking. After cool down, crank the starter again, three cycles of 10 seconds followed by 20 seconds of cool down. If the engine still fails to start, an investigation to determine the cause should be initiated.

4-20 Revision 7

AMPLIFIED PROCEDURES

PREFLIGHT INSPECTION

The Preflight Inspection, described in Figure 4-1 and adjacent checklist, is required prior to each flight. If the airplane has been in extended storage, has had recent major maintenance, or has been operated from marginal airports, a more extensive exterior inspection is recommended.

After major maintenance has been performed, the flight and trim tab controls should be double checked for free and correct movement and security. The security of all inspection plates on the airplane should be checked following periodic inspections. If the airplane has been waxed or polished, check the external static pressure source hole for stoppage.

If the airplane has been exposed to much ground handling in a crowded hangar, it should be checked for dents and scratches on wings, fuselage, and tail surfaces, damage to navigation and anticollision lights, damage to nose wheel as a result of exceeding tow limits, and avionics antennas.

Outside storage for long periods may result in dust and dirt accumulation on the induction air filter, obstructions in airspeed system lines, water contaminants in fuel tanks and insect/bird/rodent nests in any opening. If any water is detected in the fuel system, the fuel tank sump quick drain valves, fuel reservoir quick drain valve, and fuel strainer quick drain valve should all be thoroughly drained again. Then, the wings should be gently rocked and the tail lowered to the ground to move any further contaminants to the sampling points. Repeated samples should then be taken at all quick drain points until all contamination has been removed. If, after repeated sampling, evidence of contamination still exists, the fuel tanks should be completely drained and the fuel system cleaned.

Additionally, if the airplane has been stored outside in windy or gusty areas, or tied down adjacent to taxiing airplanes, special attention should be paid to control surface stops, hinges, and brackets to detect the presence of potential wind damage.

4-18 Revision 4

SHORT FIELD TAKEOFF

- 1. Wing Flaps -- 10°.
- 2. Brakes -- APPLY.
- 3. Throttle -- FULL OPEN.
- 4. Mixture -- RICH (above 3000 feet, LEAN to obtain maximum RPM).
- 5. Brakés -- RELEASE.
- 6. Elevator Control -- SLIGHTLY TAIL LOW.
- 7. Climb Speed -- 57 KIAS (until all obstacles are cleared).
- 8. Wing Flaps -- RETRACT slowly after reaching 60 KIAS.

ENROUTE CLIMB

1. Airspeed -- 70-85 KIAS.

NOTE

If a maximum performance climb is necessary, use speeds shown in the Rate Of Climb chart in Section 5.

- 2. Throttle -- FULL OPEN.
- 3. Mixture -- RICH (above 3000 feet, LEAN to obtain maximum RPM).

CRUISE

- 1. Power -- 2000-2400 RPM (No more than 80% is recommended).
- 2. Elevator Trim -- ADJUST.
- 3. Mixture -- LEAN.

DESCENT

- 1. Power -- AS DESIRED.
- 2. Mixture -- ADJUST for smooth operation.
- 3. Altimeter -- SET.
- 4. NAV/GPS Switch -- SET.
- 5. Fuel Selector Valve -- BOTH.
- 6. Wing Flaps -- AS DESIRED (0° 10° below 110 KIAS, 10° 30° below 85 KIAS).

BEFORE LANDING

- Pilot and Passenger Seat Backs -- MOST UPRIGHT POSITION.
- 2. Seats and Seat Belts -- SECURED and LOCKED.
- 3. Fuel Selector Valve -- BOTH.
- 4. Mixture -- RICH.
- 5. Landing/Taxi Lights -- ON.
- 6. Autopilot (if installed) -- OFF.

4-16 Revision 7

- b. Taxi and Landing Light Switches -- ON (to provide an initial electrical load on the system).
- c. Engine RPM -- REDUCE to idle.
 (Minimum alternator output occurs at idle.)
- d. Master Switch -- ON (with taxi and landing lights switched on).
 - (The ammeter should indicate in the negative direction, showing that the alternator output is below the load requirements, but the battery is supplying current to the system.)
- e. Éngine RPM -- INCREASE to approximately 1500 RPM (as engine RPM increases, alternator output should increase to meet the system load requirements).
- f. Ammeter and Low Voltage Annunciator -- CHECK (the ammeter should indicate in the positive direction, showing that the alternator is supplying current and the Low Voltage Annunciator (VOLTS) should not be lighted).

NOTE

If the indications, as noted in Step "d" and Step "f", are not observed, the electrical system is not functioning properly. Corrective maintenance must be performed to provide for proper electrical system operation before flight.

- 16. Navigation Lights -- ON as required.
- 17. Avionics Master Switch -- ON.
- 18. Radios -- ON.
- 19. Flaps -- RETRACT.

4-14 Revision 8

Temporary Revision for Cessna Pilot's Operating Handbook and FAA Approved Airplane Flight Manual

STARTING ENGINE (Continued)

NOTE

If engine floods (engine has been primed too much), verify auxiliary fuel pump off, set mixture to idle cutoff, open throttle 1/2 to full, and motor (crank) engine. When engine starts, set mixture to full rich and close throttle promptly.

- 12. Oil Pressure -- CHECK.
- 13. BAT Side Master Switch -- OFF (leave off at least 2 seconds).
- 14. Both BAT and ALT Sides of Master Switch -- ON.
- 15. ALT FLD Circuit Breaker -- CHECK IN.
- 16. Navigation Lights -- ON as required.
- 17. Avionics Master Switch -- ON.
- 18. Radios -- ON.
- 19. Flaps -- RETRACT.

APPROVED BY DE UNDER 14 CFR PAPT 21 SUBPART J
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Delegation Option Authorization PGA-23/504-CE

Michael D Milliam Ty --- Liminternativ

DATE OF APPROVAL 02-16-04

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STARTING ENGINE (With Battery)

- 1. Throttle -- OPEN 1/4 INCH.
- 2. Mixture -- IDLE CUTOFF.
- 3. Propeller Area -- CLEAR.
- 4. Master Switch -- ON.
- 5. Flashing Beacon -- ON.

NOTE

If engine is warm, omit priming procedure of steps 6, 7, and 8 below.

- 6. Auxiliary Fuel Pump Switch -- ON.
- 7. Mixture -- SET to FULL RICH (full forward) until stable fuel flow is indicated (usually 3 to 5 seconds), then set to IDLE CUTOFF (full aft) position.
- 8. Auxiliary Fuel Pump Switch -- OFF.
- 9. Ignition Switch -- START (release when engine starts).
- 10. Mixture -- ADVANCE smoothly to RICH when engine starts.

NOTE

If engine floods (engine has been primed too much), turn off auxiliary fuel pump, set mixture to idle cutoff, open throttle 1/2 to full, and motor (crank) engine. When engine starts, set mixture to full rich and close throttle promptly.

- 11. Oil Pressure -- CHECK.
- 12. Navigation Lights -- ON as required.
- 13. Avionics Master Switch -- ON.
- 14. Radios -- ON.
- 15. Flaps -- RETRACT.

- 2. Engine Oil Dipstick/Filler Cap -- CHECK oil level, then check dipstick/filler cap SECURE. **Do not operate with less than five quarts.** Fill to eight quarts for extended flight.
- 3. Engine Cooling Air Inlets -- CLEAR of obstructions.
- 4. Propeller and Spinner -- CHECK for nicks and security.
- 5. Air Filter -- CHECK for restrictions by dust or other foreign matter.
- 6. Nose Wheel Strut and Tire -- CHECK for proper inflation of strut and general condition (weather checks, tread depth and wear, etc...) of tire.
- 7. Left Static Source Opening -- CHECK for blockage.

6 LEFT WING

- 1. Fuel Quantity -- CHECK VISUALLY for desired level.
- 2. Fuel Filler Cap -- SECURE and VENT UNOBSTRUCTED.
- 3. Fuel Tank Sump Quick Drain Valves -- DRAIN at least a cupful of fuel (using sampler cup) from each sump location to check for water, sediment, and proper fuel grade before each flight and after each refueling. If water is observed, take further samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all fuel drain points until all contamination has been removed. If contaminants are still present, refer to WARNING on page 4-9 and do not fly airplane.
- 4. Main Wheel Tire -- CHECK for proper inflation and general condition (weather checks, tread depth and wear, etc...).

4-10 Revision 7

15. Annunciator Panel Test Switch -- RELEASE. Check that appropriate annunciators remain on.

NOTE

When Master Switch is turned ON, some annunciators will flash for approximately 10 seconds before illuminating steadily. When panel TST switch is toggled up and held in position, all remaining lights will flash until the switch is released.

- 16. Fuel Selector Valve -- BOTH.
- 17. Fuel Shutoff Valve -- ON (Push Full In).
- 18. Flaps -- EXTEND.
- 19. Pitot Heat -- ON. (Carefully check that pitot tube is warm to the touch within 30 seconds.)
- 20. Pitot Heat -- OFF.
- 21. Master Switch -- OFF.
- 22. Elevator Trim -- SET for takeoff.
- 23. Baggage Door -- CHECK, lock with key.
- 24. Autopilot Static Source Opening (if installed) -- CHECK for blockage.

EMPENNAGE

- 1. Rudder Gust Lock (if installed) -- REMOVE.
- 2. Tail Tie-Down -- DISCONNECT.
- 3. Control Surfaces -- CHECK freedom of movement and security.
- 4. Trim Tab -- CHECK security.
- 5. Antennas -- CHECK for security of attachment and general condition.

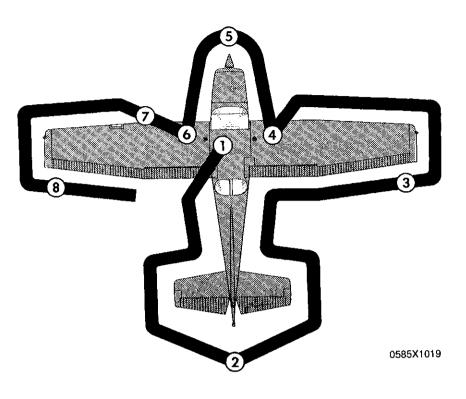
RIGHT WING Trailing Edge

- 1. Aileron -- CHECK freedom of movement and security.
- 2. Flap -- CHECK for security and condition.

(4) RIGHT WING

1. Wing Tie-Down -- DISCONNECT.

Revision 7 4-8



NOTE

Visually check airplane for general condition during walk-around inspection. Airplane should be parked in a normal ground attitude (refer to Figure 1-1) to ensure that fuel drain valves allow for accurate sampling. Use of the refueling steps and assist handles will simplify access to the upper wing surfaces for visual checks and refueling operations. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. Prior to flight, check that pitot heater is warm to touch within 30 seconds with battery and pitot heat switches on. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-1. Preflight Inspection

TABLE OF CONTENTS (Continued)

	Page
Landing	4-17
Normal Landing	4-17
Short Field Landing	4-17
Balked Landing	4-17
After Landing	4-17
Securing Airplane	4-17
AMPLIFIED PROCEDURES	
Preflight Inspection	4-18
Starting Engine	4-19
Recommended Starter Duty Cycle	4-20
Leaning For Ground Operations	4-21
Taxiing	4-21
Before Takeoff	4-23
Warm Up	4-23
Magneto Check	4-23
Alternator Check	4-23
Landing Lights	4-24
Takeoff	4-24
Power Check	4-24
Wing Flap Settings	4-25
Crosswind Takeoff	4-25
Enroute Climb	4-25
Cruise	4-26
Leaning With EGT Indicator	4-27
Fuel Savings Procedures for Flight Training Operations .	. 4-28
Fuel Vapor Procedures	4-29
Stalls	4-30
China	4-30

Revision 7

Applicability: This document communicates safety warning information concerning aircraft using air pumps to power gyro flight instruments while flying Instrument Flight Rules (IFR).

WARNING: FAILURE TO FOLLOW THE FOLLOWING INSTRUCTIONS MAY RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE:

- A BACK-UP PNEUMATIC POWER SOURCE FOR THE AIR DRIVEN GYROS, OR A BACK-UP ELECTRIC ATTITUDE GYRO INSTRUMENT, MUST BE INSTALLED IN ALL AIRCRAFT WHICH FLY IFR.
- 2. ANY INOPERATIVE AIR PUMP OR OTHER COMPONENT OF THE GYRO SYSTEM, AND ANY INOPERATIVE BACK-UP SYSTEM OR COMPONENT, MUST BE REPLACED PRIOR TO THE NEXT FLIGHT.
- 3. THIS PILOT SAFETY WARNING MUST BE PERMANENTLY RETAINED IN THE PILOT'S OPERATING HANDBOOK FOR THE AIRCRAFT INTO WHICH THIS AIR PUMP IS INSTALLED.

Explanation: Failure of the air pump or any other component of the pneumatic system during IFR flight in Instrument Meteorological Conditions (IMC) can lead to spatial disorientation of the pilot and subsequent loss of aircraft control. This could result in an accident causing death, bodily injury, or property damage.

Use of single-engine aircraft in IMC is increasing. Many single-engine aircraft do not have a back-up pneumatic power source or back-up electric attitude gyro instruments. In aircraft without such back-up devices, the pilot due to added workload may not be able to fly the aircraft with only "partial panel" instruments (that is, turn and slip indicator, altimeter, and airspeed indicator) in the event of primary air pump or pneumatic system failure during IMC.

Air pump or pneumatic system failures can and do occur without warning. This can be a result of various factors, including but not limited to normal wear-out of components, improper installation or maintenance, premature failure, or the use of substandard overhauled components. It is recommended that an annunciator light or other device be installed to warn the pilot of loss of gyro power so that the pilot can take corrective action prior to the loss of correct gyro information.

Since air pump life cannot be accurately predicted and air pumps can fail without warning, the instructions set forth in this document must be followed.

OPERATING HANDBOOK

PLACE IN PILOT'S

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and low voltage annunciator (VOLTS); however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is most likely the cause of alternator failures, although other factors could cause the problem. A defective alternator control unit can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The following paragraphs describe the recommended remedy for each situation.

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than two needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate.

Electronic components in the electrical system can be adversely affected by higher than normal voltage. The alternator control unit includes an overvoltage sensor which normally will automatically shut down the alternator if the charge voltage reaches approximately 31.5 volts. If the overvoltage sensor malfunctions, as evidenced by an excessive rate of charge shown on the ammeter, the alternator should be turned off, nonessential electrical equipment turned off and the flight terminated as soon as practical.

3-22 Revision 7

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

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3-22 Revision 7

ROUGH ENGINE OPERATION OR LOSS OF POWER

SPARK PLUG FOULING

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the recommended lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single ignition position.

MAGNETO MALFUNCTION

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if continued operation on BOTH magnetos is possible. If not, switch to the good magneto and proceed to the nearest airport for repairs.

ENGINE-DRIVEN FUEL PUMP FAILURE

Failure of the engine-driven fuel pump will result in an immediate loss of engine power, similar to fuel exhaustion or starvation, but while operating from a fuel tank containing adequate fuel. A sudden reduction in indicated fuel flow will occur just before loss of engine power.

If the engine-driven fuel pump fails, immediately set the auxiliary fuel pump switch (FUEL PUMP) to the ON position to restore engine power. The flight should be terminated as soon as practical and the engine-driven fuel pump repaired.

3-20 Revision 7

RECOVERY FROM SPIRAL DIVE IN THE CLOUDS

If a spiral is encountered in the clouds, proceed as follows:

- 1. Retard throttle to idle position.
- 2. Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
- Cautiously apply elevator back pressure to slowly reduce the airspeed to 80 KIAS.
- 4. Adjust the elevator trim control to maintain an 80 KIAS glide.
- Keep hands off the control wheel, using rudder control to hold a straight heading.
- Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
- 7. Upon breaking out of clouds, resume normal cruising flight.

INADVERTENT FLIGHT INTO ICING CONDITIONS

Flight into icing conditions is **prohibited** and extremely dangerous. An inadvertent encounter with these conditions can best be handled using the checklist procedures. The best procedure, of course, is to turn back or change altitude to escape icing conditions.

During these encounters, an unexplained loss in engine speed could be caused by ice blocking the air intake filter, or, in extremely rare instances, ice completely blocking the fuel injection air reference tubes. In either case, the throttle should be positioned to obtain maximum RPM (in some instances, the throttle may need to be retarded for maximum power). The mixture should then be adjusted, as required, to obtain maximum RPM.

STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter and vertical speed) are suspected, the static pressure alternate source valve should be pulled ON, thereby supplying static pressure to these instruments from the cabin.

3-18 Revision 7

At the landing flare (round-out), the nose down moment resulting from power reduction is an adverse factor and the airplane may land on the nose wheel. Consequently, at flare, the elevator trim control should be adjusted toward the full nose up position and the power adjusted so that the airplane will rotate to the horizontal attitude for touchdown. Close the throttle at touchdown.

FIRES

Although engine fires are extremely rare in flight, the steps of the appropriate checklist should be followed if one is encountered. After completion of this procedure, execute a forced landing. Do not attempt to restart the engine.

The initial indication of an electrical fire is usually the odor of burning insulation. The checklist for this problem should result in elimination of the fire.

EMERGENCY OPERATION IN CLOUDS (Total Vacuum System Failure)

If both the vacuum pumps fail in flight, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator if he inadvertently flies into clouds. If an autopilot is installed, it too may be affected. Refer to Section 9, Supplements, for additional details concerning autopilot operation. The following instructions assume that only the electrically powered turn coordinator is operative, and that the pilot is not completely proficient in instrument flying.

EXECUTING A 180° TURN IN CLOUDS

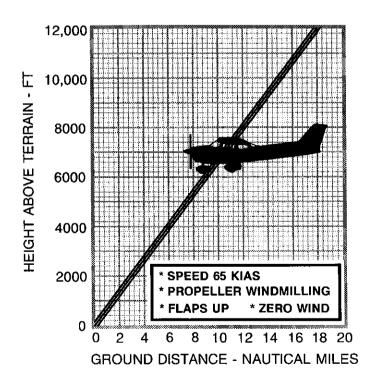
Upon inadvertently entering the clouds, an immediate plan should be made to turn back as follows:

1. Note the compass heading.

2. Using the clock, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.

3-16 Revision 7

After an engine failure in flight, the most important course of action is to continue flying the airplane. Best glide speed as shown in Figure 3-1 should be established as quickly as possible. While gliding toward a suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in the checklist. If the engine cannot be restarted, a forced landing without power must be completed.



0585C1011

Figure 3-1. Maximum Glide

3-14 Revision 7

VACUUM SYSTEM FAILURE

Left Vacuum (L VAC) Annunciator or Right Vacuum (VAC R) Annunciator Illuminates.

A CAUTION

IF VACUUM IS NOT WITHIN NORMAL OPERATING LIMITS, A FAILURE HAS OCCURRED IN THE VACUUM SYSTEM AND PARTIAL PANEL PROCEDURES MAY BE REQUIRED FOR CONTINUED FLIGHT.

1. Vacuum Gage -- CHECK to ensure vacuum within normal operating limits.

- 10. Approach at 65 to 75 KIAS depending upon the amount of the accumulation.
- 11. Perform a landing in level attitude.

STATIC SOURCE BLOCKAGE (Erroneous Instrument Reading Suspected)

- 1. Static Pressure Alternate Source Valve -- PULL ON.
- 2. Airspeed -- Consult appropriate calibration tables in Section 5.

LANDING WITH A FLAT MAIN TIRE

- 1. Approach -- NORMAL.
- 2. Wing Flaps -- 30°.
- 3. Touchdown -- GOOD MAIN TIRE FIRST, hold airplane off flat tire as long as possible. with aileron control.
- 4. Directional Control -- MAINTAIN using brake on good wheel as required.

LANDING WITH A FLAT NOSE TIRE

- 1. Approach -- NORMAL.
- 2. Flaps -- AS REQUIRED.
- 3. Touchdown -- ON MAINS, hold nose wheel off the ground as long as possible.
- 4. When nose wheel touches down, maintain full up elevator as airplane slows to stop.

3-10 Revision 4

ELECTRICAL FIRE IN FLIGHT

- 1. Master Switch -- OFF.
- 2. Vents, Cabin Air, Heat -- CLOSED.
- 3. Fire Extinguisher -- ACTIVATE (if available).
- 4. Avionics Master Switch -- OFF.
- 5. All Other Switches (except ignition switch) -- OFF.

A WARNING

AFTER DISCHARGING FIRE EXTINGUISHER AND ASCERTAINING THAT FIRE HAS BEEN EXTINGUISHED, VENTILATE THE CABIN.

6. Vents/Cabin Air/Heat -- OPEN when it is ascertained that fire is completely extinguished.

If fire has been extinguished and electrical power is necessary for continuance of flight to nearest suitable airport or landing area:

- Master Switch -- ON.
- 8. Circuit Breakers -- CHECK for faulty circuit, do not reset.
- 9. Radio Switches -- OFF,
- 10. Avionics Master Switch -- ON.
- 11. Radio/Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.

CABIN FIRE

- 1. Master Switch -- OFF.
- 2. Vents/Cabin Air/Heat -- CLOSED (to avoid drafts).
- 3. Fire Extinguisher -- ACTIVATE (if available).

A WARNING

AFTER DISCHARGING FIRE EXTINGUISHER AND BEEN ASCERTAINING THAT FIRE HAS EXTINGUISHED, VENTILATE THE CABIN.

- 4. Vents/Cabin Air/Heat -- Open when it is ascertained that fire is completely extinguished.
- 5. Land the airplane as soon as possible to inspect for damage.

PRECAUTIONARY LANDING WITH ENGINE POWER

- 1. Passenger Seat Backs -- MOST UPRIGHT POSITION.
- Seats and Seat Belts -- SECURE.
- 3. Airspeed -- 60 KIAS.
- 4. Wing Flaps -- 20°.
- 5. Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
- 6. Avionics Master Switch and Electrical Switches -- OFF.
- 7. Wing Flaps -- 30° (on final approach).
- 8. Airspeed -- 60 KIAS.
- 9. Master Switch -- OFF.
- 10. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
- 11. Touchdown -- SLIGHTLY TAIL LOW.
- 12. Ignition Switch -- OFF.
- 13. Mixture -- IDLE CUTOFF.
- 14. Brakes -- APPLY HEAVILY.

DITCHING

- Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700.
- 2. Heavy Objects (in baggage area) -- SECURE OR JETTISON (if possible).
- 3. Passenger Seat Backs -- MOST UPRIGHT POSITION.
- 4. Seats and Seat Belts -- SECURE.
- 5. Wing Flaps -- 20° to 30°.
- 6. Power -- ESTABLISH 300 FT/MIN DESCENT AT 55 KIAS.

NOTE

If no power is available, approach at 65 KIAS with flaps up or at 60 KIAS with 10° flaps.

- 7. Approach -- High Winds, Heavy Seas -- INTO THE WIND. Light Winds, Heavy Swells -- PARALLEL TO SWELLS.
- 8. Cabin Doors -- UNLATCH.
- 9. Touchdown -- LEVEL ATTITUDE AT ESTABLISHED RATE OF DESCENT.
- 10. Face -- CUSHION at touchdown with folded coat.
- 11. ELT -- Activate.
- 12. Airplane -- EVACUATE through cabin doors. If necessary, open window and flood cabin to equalize pressure so doors can be opened.
- 13. Life Vests and Raft -- INFLATE WHEN CLEAR OF AIRPLANE.

EMERGENCY PROCEDURES CHECKLIST

Procedures in the Emergency Procedures Checklist portion of this section shown in **bold faced** type are immediate action items which should be committed to memory.

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF ROLL

- 1. Throttle -- IDLE.
- 2. Brakes-- APPLY.
- 3. Wing Flaps -- RETRACT.
- 4. Mixture -- IDLE CUT OFF.
- 5. Ignition Switch -- OFF.
- 6. Master Switch -- OFF.

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

- 1. Airspeed -- 65 KIAS (flaps UP). 60 KIAS (flaps DOWN).
- 2. Mixture -- IDLE CUT OFF.
- 3. Fuel Shutoff Valve -- OFF (Pull Full Out).
- 4. Ignition Switch -- OFF.
- 5. Wing Flaps -- AS REQUIRED.
- 6. Master Switch -- OFF.
- 7. Cabin Door -- UNLATCH.
- 8. Land -- STRAIGHT AHEAD.

TABLE OF CONTENTS (Continued)

	Page
Electrical Power Supply System Malfunctions Ammeter Shows Excessive Rate of Charge	. 3-11
(Full Scale Deflection)	3-11 ght
(Ammeter Indicates Discharge)	3-11
Vacuum System Failure	3-12
AMPLIFIED EMERGENCY PROCEDURES	
Engine Failure	3-13
Forced Landings	3-15
Landing Without Elevator Control	3-15
Fires	3-16
Emergency Operation In Clouds (Vacuum System Failure)	. 3-16
Executing A 180° Turn In Clouds	. 3-16
Emergency Descent Through Clouds	. 3-17
Recovery From Spiral Dive In The Clouds	. 3-18
Inadvertent Flight Into Icing Conditions	
Static Source Blocked	
Spins	
Rough Engine Operation Or Loss Of Power	
Spark Plug Fouling	
Magneto Malfunction	
Engine-Driven Fuel Pump Failure	
Excessive Fuel Vapor Indications	
Low Oil Pressure	
Electrical Power Supply System Malfunctions	
Excessive Rate of Charge	
Insufficient Rate Of Charge 3	
Other Emergencies	
Windshield Damage	;-23/3-24

3-2 Revision 7

,			

5. In baggage compartment:

120 POUNDS MAXIMUM BAGGAGE FORWARD OF BAGGAGE DOOR LATCH

50 POUNDS MAXIMUM BAGGAGE AFT OF BAGGAGE DOOR LATCH

MAXIMUM 120 POUNDS COMBINED

FOR ADDITIONAL LOADING INSTRUCTIONS SEE WEIGHT AND BALANCE DATA

- 6. A calibration card must be provided to indicate the accuracy of the magnetic compass in 30° increments.
- 7. On the oil filler cap:

OIL 8 QTS

8. On control lock:

CAUTION! CONTROL LOCK REMOVE BEFORE STARTING ENGINE

9. Near airspeed indicator:

MANEUVERING SPEED - 99 KIAS

PLACARDS

The following information must be displayed in the form of composite or individual placards.

1. In full view of the pilot: (The "DAY-NIGHT-VFR-IFR" entry, shown on the example below, will vary as the airplane is equipped).

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category or in the Utility Category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

Normal Category	No acrobatic maneuvers,	including	spins,
	annroved		

approved.

Utility Category No acrobatic maneuvers approved,

except those listed in the Pilot's

Operating Handbook.

Baggage compartment and rear seat

must not be occupied.

Spin Recovery Opposite rudder - forward elevator -

neutralize controls.

Flight into known icing conditions prohibited.

This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY-NIGHT-VFR-IFR

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

Flight Load Factors (Maximum Takeoff Weight -	· 2450 lbs.):
*Flaps Up	+3.8g, -1.52g
*Flaps Down	+3.0g

*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

UTILITY CATEGORY

Flight Load Factors (Maximum Takeoff Weight -	· 2100 lbs.):
*Flaps Up	+4.4g, -1.76g
*Flaps Down	+3.0g

*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

KINDS OF OPERATION LIMITS

The airplane as delivered is equipped for day VFR and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instrumentation and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time of Airworthiness Certificate issuance.

Flight into known icing conditions is prohibited.

2-10 Revision 7

UTILITY CATEGORY

Center of Gravity Range:

Forward: 35.0 inches aft of datum at 1950 lbs. or less, with

straight line variation to 36.5 inches aft of datum at

2100 lbs.

Aft: 40.5 inches aft of datum at all weights.

Reference Datum: Lower portion of front face of firewall.

MANEUVER LIMITS

NORMAL CATEGORY

This airplane is certificated in both the normal and utility category. The normal category is applicable to aircraft intended for non aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and turns in which the angle of bank is not more than 60°.

NORMAL CATEGORY MANEUVERS AND RECOMMENDED ENTRY SPEED*

Chandelles	
Lazy Eights	105 Knots
Steep Turns	. 95 Knots
Stalls (Except Whip Stalls) Slow I	Deceleration

^{*} Abrupt use of the controls is prohibited above 99 knots.

2-8 Dec 2/96

Fuel Grade: See Fuel Limitations.

Oil Grade (Specification):

MIL-L-6082 or SAE J1966 Aviation Grade Straight Mineral Oil or MIL-L-22851 or SAE J1899 Ashless Dispersant Oil. Oil must comply with the latest revision and/or supplement for Textron Lycoming Service Instruction No. 1014.

Propeller Manufacturer: McCauley Propeller Systems.

Propeller Model Number: 1C235/LFA7570.

Propeller Diameter: 75 inches.

74 inch minimum.

POWERPLANT INSTRUMENT MARKINGS

Powerplant instrument markings and their color code significance are shown in Figure 2-3.

INSTRUMENT	RED LINE (MINIMUM)	GREEN ARC (NORMAL OPERATING)	RED LINE (MAX)
Tachometer:		1900 to 2400 RPM	2400 RPM
Oil Temperature		100 to 245°F	245°F
Oil Pressure	20 PSI	50 to 90 PSI	115 PSI
Fuel Quantity	0 (1.5 Gal. Unusable Each Tank)		
Fuel Flow		0 to 11 GPH	
Vacuum Gage		4.5 - 5.5 in.Hg	

Figure 2-3. Powerplant Instrument Markings

2-6 Revision 7

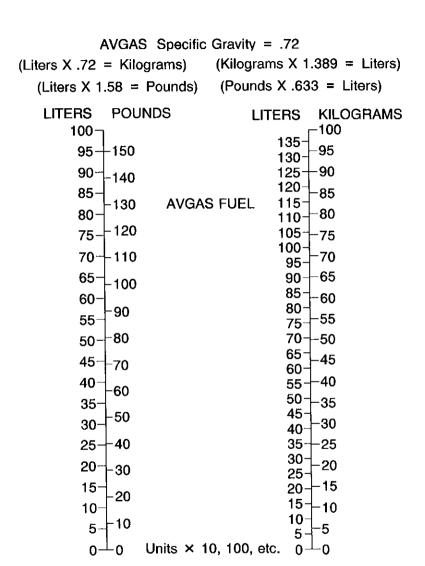
AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in Figure 2-1. Maneuvering speeds shown apply to normal category operations. The utility category maneuvering speed is 92 KIAS at 2100 pounds.

SYMBOL	SPEED	KCAS	KIAS	REMARKS
V _{NE}	Never Exceed Speed	160	163	Do not exceed this speed in any operation.
V _{NO}	Maximum Structural Cruising Speed	126	129	Do not exceed this speed except in smooth air, and then only with caution.
VA	Maneuvering Speed: 2450 Pounds 2000 Pounds 1600 Pounds	97 91 82	99 92 82	Do not make full or abrupt control movements above this speed.
V _{FE}	Maximum Flap Extended Speed: 10° Flaps 10° to 30° Flaps	108 84	110 85	Do not exceed this speed with flaps down.
••••	Maximum Window Open Speed	160	163	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

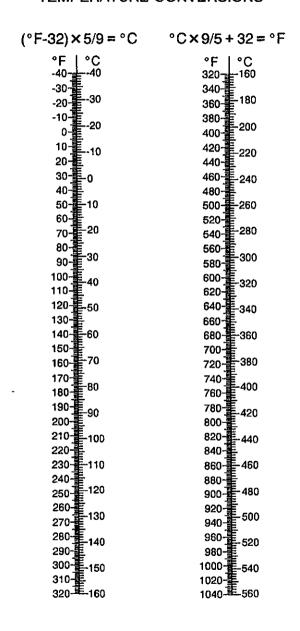
Revision 7



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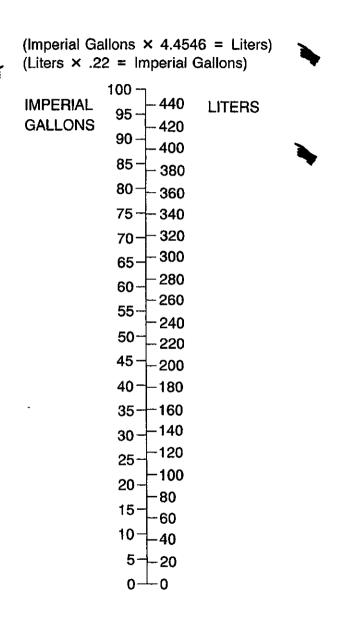
Figure 1-9. Volume to Weight Conversion

TEMPERATURE CONVERSIONS



0585T1034

Figure 1-7. Temperature Conversions



Units × 10, 100, etc.

0585T1032

Figure 1-6. Volume Conversions (Sheet 2 of 3)

1.22 Eph 28/00

(Statute Miles ×1.609=Kilometers) (Kilometers ×.622=Statute Miles) (Statute Miles ×.869=Nautical Miles) (Nautical Miles ×1.15=Statute Miles) (Nautical Miles ×1.852=Kilometers) (Kilometers ×.54=Nautical Miles)

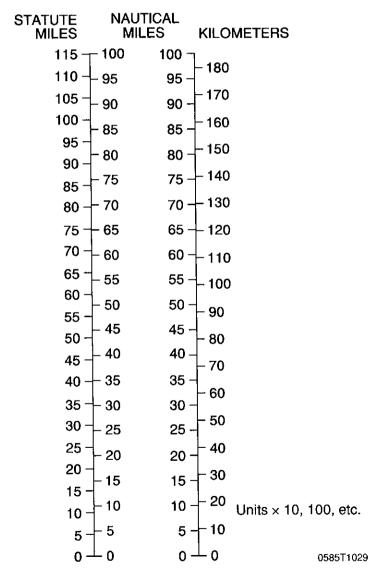


Figure 1-5. Distance Conversions

1-20 Revision 7

(Centimeters \times .394 = Inches) (Inches \times 2.54 = Centimeters)

CENTIMETERS INTO INCHES CENTIMETRES EN POUCES

cm	0	1	2	3	4	5	6	7	8	9
	in.									
0		0.394	0.787	1.181	1.575	1.969	2.362	2.756	3.150	3.543
10	3.937	4.331	4.724	5.118	5.512	5.906	6.299	6.693	7.087	7.480
20	7.874	8.268	8.661	9.055	9.449	9.843	10.236	10.630	11.024	11.417
30	11.811	12.205	12.598	12.992	13.386	13.780	14.173	14.567	14.961	15.354
40	15.748	16.142	16.535	16.929	17.323	17.717	18.110	18.504	18.898	19.291
									l	
50	19.685	20.079	20.472	20.866	21.260	21.654	22.047	22.441	22.835	23.228
60	23.622	24.016	24.409	24.803	25.197	25.591	25.984	26.378	26.772	27.164
70	27.559	27.953	28.346	28.740	29.134	29.528	29.921	30.315	30.709	31.102
80	31.496	31.890	32.283	32.677	33.071	33.465	33.858	34.252	34.646	35.039
90	35.433	35.827	36.220	36.614	37.008	37.402	37.795	38.189	38.583	38.976
100	39.370	39.764	40.157	40.551	40.945	41.339	41.732	42.126	42.520	42.913

INCHES INTO CENTIMETERS POUCES EN CENTIMETRES

in.	0	1	2	3	4	5	6 7		8	9
	cm									
0		2.54	5.08	7.62	10.16	12.70	15.24	17.78	20.32	22.96
10	25.40	27.94	30.48	33.02	35.56	38.10	40.64	43.18	45.72	48.26
20	50.80	53.34	55.88	58.42	60.96	63.50	66.04	68.58	71.12	73.66
30	76.20	78.74	81.28	83.82	86.36	88.90	91.44	93.98	96.52	99.06
40	101.60	104.14	106.68	109.22	111.76	114.30	116.84	119.38	121.92	124.46
50	127.00	129.54	132.08	134.62	137.16	139.70	142.24	144.78	147.32	149.86
60	152.40	154.94	157.48	160.02	162.56	165.10	167.64	170.18	172.72	175.26
70	177.80	180.34	182.88	185.42	187.96	190.50	193.04	195.58	198.12	200.66
80	203.20	205.74	208.28	210.82	213.36	215.90	218.44	220.98	223.52	226.06
90	228.60	231.14	233.68	236.22	238.76	241.30	243.84	246.38	248.92	251.46
								ļ		
100	254.00	256.54	259.08	261.62	264.16	266.70	269.24	271.78	274.32	276.86

Figure 1-4. Length Conversions (Sheet 1 of 2)

1-18 Revision 4

(Meters \times 3.281 = Feet) (Feet \times .305 = Meters)

METERS INTO FEET METERES EN PIEDS

m	0	1	2	3	4	5	6	7	8	9
	feet									
0		3.281	6.562	9.842	13.123	16.404	19.685	22.956	26.247	29.528
10	32.808	36.089	39.370	42.651	45.932	49.212	52.493	55.774	59.055	62.336
20	65.617	68.897	72.178	75.459	78.740	82.021	85.302	88.582	91.863	95.144
30	98.425	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.79	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.86	177.16	180.45	183.73	187.01	190.29	193.57
60	195.85	200.13	203.41	206.69	209.97	213.25	216.53	219.82	223.10	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.90	259.19
80	262.47	265.75	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.58
90	295.27	298.56	301.84	305.12	308.40	311.68	314.96	318.24	321.52	324.80
100	328.08	331.36	334.64	337.93	341.21	344.49	347.77	351.05	354.33	357.61

FEET INTO METERS PIEDS EN METRES

	PIEDS EN METRES									
ft	0	1	2	3	4	5	6	7	8	9
ļ	m	m	m	m	m	m	m	m	m	m
0		0.305	0.610	0.914	1.219	1.524	1.829	2.134	2.438	2.743
10	3.048	3.353	3.658	3.962	4.267	4.572	4.877	5.182	5.486	5.791
20	6.096	6.401	6.706	7.010	7.315	7.620	7.925	8.230	8.534	8.839
30	9.144	9.449	9.754	10.058	10.363	10.668	10.973	11.278	11.582	11.887
40	12.192	12.497	12.802	13.106	13.411	13.716	14.021	14.326	14.630	14.935
50	15.240	15.545	15.850	16.154	16.459	16.754	17.069	17.374	17.678	17.983
60	18.288	18.593	18.898	19.202	19.507	19.812	20.117	20.422	20.726	21.031
70	21.336	21.641	21.946	22.250	22.555	22.860	23.165	23.470	23.774	24.079
80	24.384	24.689	24.994	25.298	25.603	25.908	26.213	26.518	26.822	27.127
90	27.432	27.737	28.042	28.346	28.651	28.956	29.261	29.566	29.870	30.175
	1							,		
100	30.480	30.785	31.090	31.394	31.699	32.004	32.309	32.614	32.918	33.223

Figure 1-3. Length Conversions (Sheet 1 of 2)

1-16 Feb 28/00

(Kilograms \times 2.205 = Pounds) (Pounds \times .454 = Kilograms)

KILOGRAMS INTO POUNDS KILOGRAMMES EN LIVRES

kg	0	1	2	3	4	5	6	7	8	9
	lb.									
0		2.205	4.409	6.614	8.819	11.023	13.228	15.432	17.637	19.842
10	22.046	24.251	26.456	28.660	30.865	33.069	35.274	37.479	39.683	41.888
20	44.093	46.297	48.502	50.706	52.911	55.116	57.320	59.525	61.729	63.934
30	66.139	68.343	70.548	72.753	74.957	77.162	79.366	81.571	83.776	85.980
40	88.185	90.390	92.594	94.799	97.003	99.208	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26
	1								1	
100	220.46	222.67	224.87	227.08	229.28	231.49	233.69	235.90	238.10	240.30

POUNDS INTO KILOGRAMS LIVRES EN KILOGRAMMES

lb.	0	1	2	3	4	5	6	7	8	9
	kg									
0		0.454	0.907	1.361	1.814	2.268	2.722	3.175	3.629	4.082
10	4.536	4.990	5.443	5.897	6.350	6.804	7.257	7.711	8.165	8.618
20	9.072	9.525	9.979	10.433	10.886	11.340	11.793	12.247	12.701	13.154
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.303	26.762
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298
70	31.752	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370
90	40.823	41.277	41.731	42.184	42.638	43.091	43.545	43.999	44.452	44.906
100	45.359	45.813	46.266	46.720	47.174	47.627	48.081	48.534	48.988	49.442

Figure 1-2. Weight Conversions (Sheet 1 of 2)

1-14 Revision 7

WEIGHT AND BALANCE TERMINOLOGY (Continued)

WEIGHT AND	J BALANCE TERMINOLOGY (Continued)
C.G. Arm	Center of Gravity Arm is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	Center of Gravity Limits are the extreme center of gravity locations within which the airplane must be operated at a given weight.
Standard Empty Weight	Standard Empty Weight is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	Basic Empty Weight is the standard empty weight plus the weight of optional equipment.
Useful Load	Useful Load is the difference between ramp weight and the basic empty weight.
MAC	MAC (Mean Aerodynamic Chord) is the chord of an imaginary rectangular airfoil having the same pitching moments throughout the flight range as that of the actual wing.
Maximum Ramp Weight	Maximum Ramp Weight is the maximum weight approved for ground maneuver, and includes the weight of fuel used for start, taxi and runup.
Maximum Takeoff Weight	Maximum Takeoff Weight is the maximum weight approved for the start of the takeoff roll.
Maximum Landing Weight	Maximum Landing Weight is the maximum weight approved for the landing touchdown.
Tare	Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

-12 Revision 7

ENGINE POWER TERMINOLOGY (Continued)

Full Throttle Throttle full forward (pushed in, full control travel. toward the panel) Also known as "full open" throttle.

Closed Throttle Throttle full aft (pulled out, full control travel, away from the panel). Also known as the throttle "idle" position.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING **TERMINOLOGY**

Demonstrated Crosswind Velocity

Demonstrated Crosswind Velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.

Usable Fuel

Usable Fuel is the fuel available for flight planning.

Unusable **Fuel**

Unusable Fuel is the quantity of fuel that can not be safely used in flight.

Gallons Per Hour is the amount of fuel consumed

per hour.

NMPG

GPH

Nautical Miles Per Gallon is the distance which can be expected per gallon of fuel consumed at a and/or flight power setting specific engine

configuration.

g

g is acceleration due to gravity.

Course Datum

Course Datum is the compass reference used by the autopilot, along with course deviation, to provide lateral control when tracking a navigation signal.

GPH

ENGINE POWER TERMINOLOGY (Continued)

Full Throttle full forward (pushed in, full control travel, Throttle toward the panel) Also known as "full open" throttle.

Closed Throttle full aft (pulled out, full control travel, away from the panel). Also known as the throttle "idle"

position.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demonstrated Crosswind Velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.

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Gallons Per Hour is the amount of fuel consumed

per hour.

NMPG Nautical Miles Per Gallon is the distance which can

be expected per gallon of fuel consumed at a specific engine power setting and/or flight

configuration.

g g is acceleration due to gravity.

Course Datum is the compass reference used by the autopilot, along with course deviation, to provide

lateral control when tracking a navigation signal.

1-10 Revision 7

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS	Knots Calibrated Airspeed is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.
KIAS	Knots Indicated Airspeed is the speed shown on the airspeed indicator and expressed in knots.
	se a Turn Stranger to the element overcoood in

KTAS	Knots True Airspeed is the airspeed expressed in
	knots relative to undisturbed air which is KCAS
	corrected for altitude and temperature.

V_{A}	Maneuvering	Speed	s	the	maximum	speed	at
Λ,	which full or a	brupt co	ntro	l mo	vements ma	ay be us	ed
	without overst	ressing th	ie a	irfran	ne.		

	Maximum						
12	speed per extended p		wing	flaps	in	a pr	escribed

V_{NO}	Maximum Structural Cruising Speed is the speed
,,,	that should not be exceeded except in smooth air,
	then only with caution.

Never Exceed	Speed is	the s	speed	limit	that	may	not
be exceeded at	any time.						

Stalling	Speed	or	the	mini	imum	stea	ady	flig	ht
speed is	the mini	mun	i spe	ed at	t which	the	airpl	ane	is
controllab			•						

V_{SO}	Stalling	Speed	or	the	minimum	steady	flight
90	speed is	the mini	imur	n spe	ed at which	the airp	lane is
				_	configuration	on at the	e most
	forward of	enter of	grav	ity.			

Best Angle-of-Climb results in the greates	Speed	is	the	spee	d	which
results in the greates	t gain	of a	altitud	le' in	а	given
horizontal distance.						

V_Y Best Rate-of-Climb Speed is the speed which results in the greatest gain in altitude in a given time.

 V_{NE}

 V_{S}

 V_X

Recommended Viscosity for Temperature Range:

Temperature	MIL-L-6082 or SAE J1966 Straight Mineral Oil SAE Grade	MIL-L-22851 or SAE J1899 Ashless Dispersant SAE Grade
Above 27°C (80°F)	60	60
Above 16°C (60°F)	50	40 or 50
-1°C (30°F) to 32°C (90°F)	40	40
-18°C (0°F) to 21°C (70°F)	30	30, 40 or 20W-40
Below -12°C (10°F)	20	30 or 20W-30
-18°C (0°F) to 32°C (90°F)	20W-50	20W-50 or 15W-50
All Temperatures		15W-50 or 20W-50

NOTE

When operating temperatures overlap, use the lighter grade of oil.

Oil Capacity:

Sump: 8 U.S. Quarts Total: 9 U.S. Quarts

MAXIMUM CERTIFICATED WEIGHTS

Ramp Weight

Normal Category: 2457 lbs. 2107 lbs.

Takeoff Weight

Normal Category: 2450 lbs. 2100 lbs.

Landing Weight

Normal Category: 2450 lbs. 2100 lbs.

Utility Category: 2450 lbs. 2100 lbs.

INTRODUCTION

This handbook contains 8 sections, and includes the material required to be furnished to the pilot by FAR Part 23. It also contains supplemental data supplied by The Cessna Aircraft Company.

Section 1 provides basic data and information of general interest. It also contains definitions or explanations of symbols, abbreviations, and terminology commonly used.

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1.

Engine Manufacturer: Textron Lycoming. Engine Model Number: IO-360-L2A.

Engine Type: Normally aspirated, direct drive, air-cooled,

horizontally opposed, fuel injected, four cylinder

engine with 360 cu. in. displacement. Horsepower Rating and Engine Speed: 160 rated BHP

at 2400 RPM.

PROPELLER

Propeller Manufacturer: McCauley Propeller Systems.

Propeller Model Number: 1C235/LFA7570.

Number of Blades: 2.

Propeller Diameter: 75 inches. Propeller Type: Fixed pitch.

FUEL

A WARNING

USE OF UNAPPROVED FUELS MAY RESULT IN DAMAGE TO THE ENGINE AND FUEL SYSTEM COMPONENTS, RESULTING IN POSSIBLE ENGINE FAILURE.

Approved Fuel Grades (and Colors):

100LL Grade Aviation Fuel (Blue). 100 Grade Aviation Fuel (Green).

1-4

Feb 28/97

INTRODUCTION

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FUEL

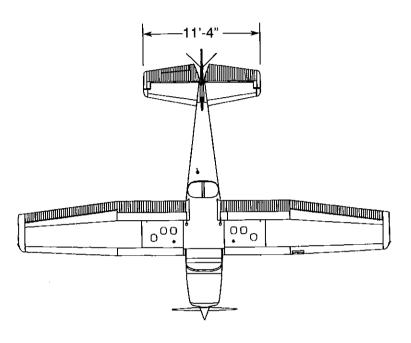
A WARNING

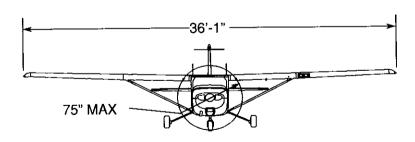
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1-4 Revision 7





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Figure 1-1. Three View - Normal Ground Attitude (Sheet 1 of 2)